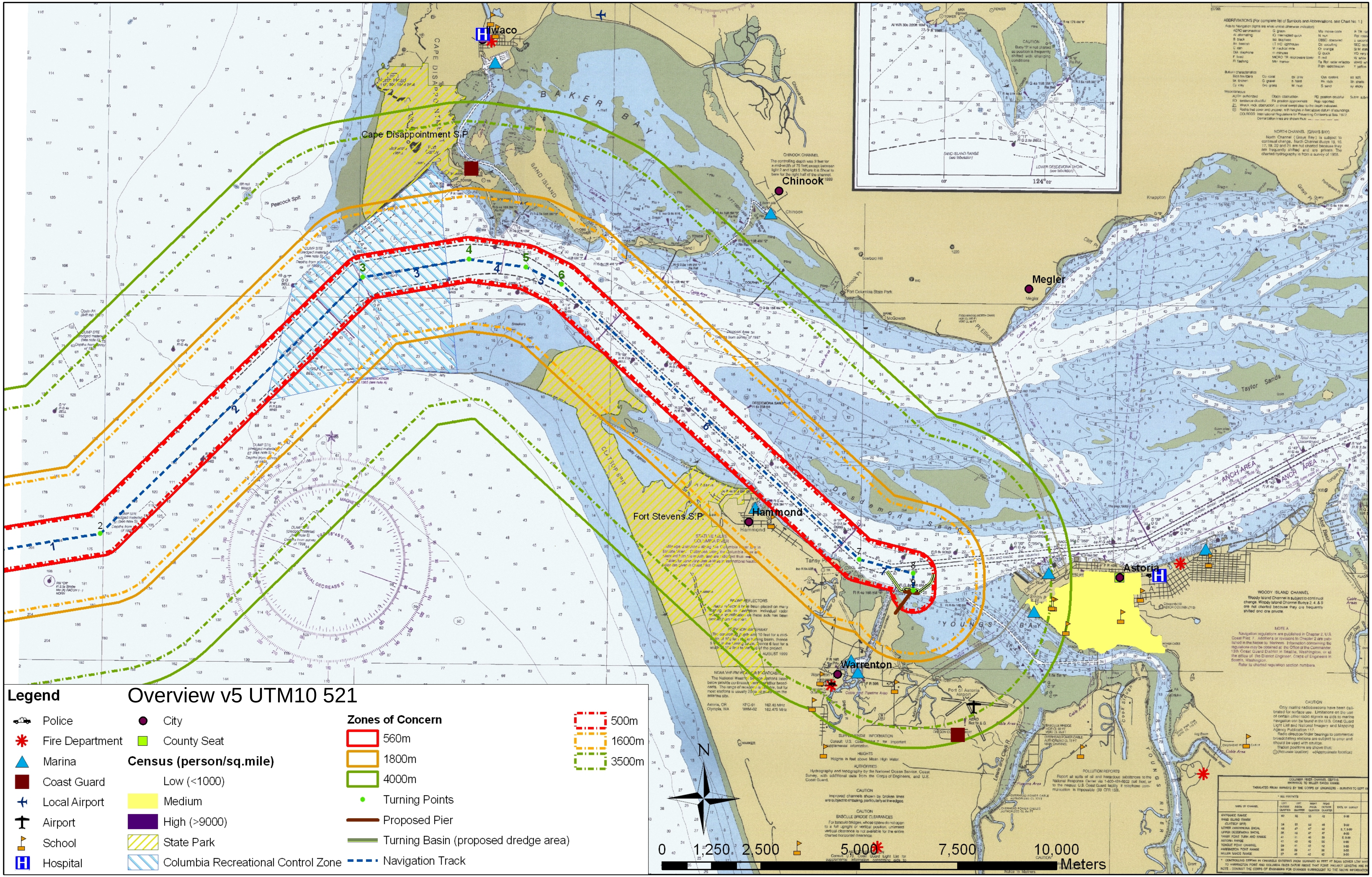
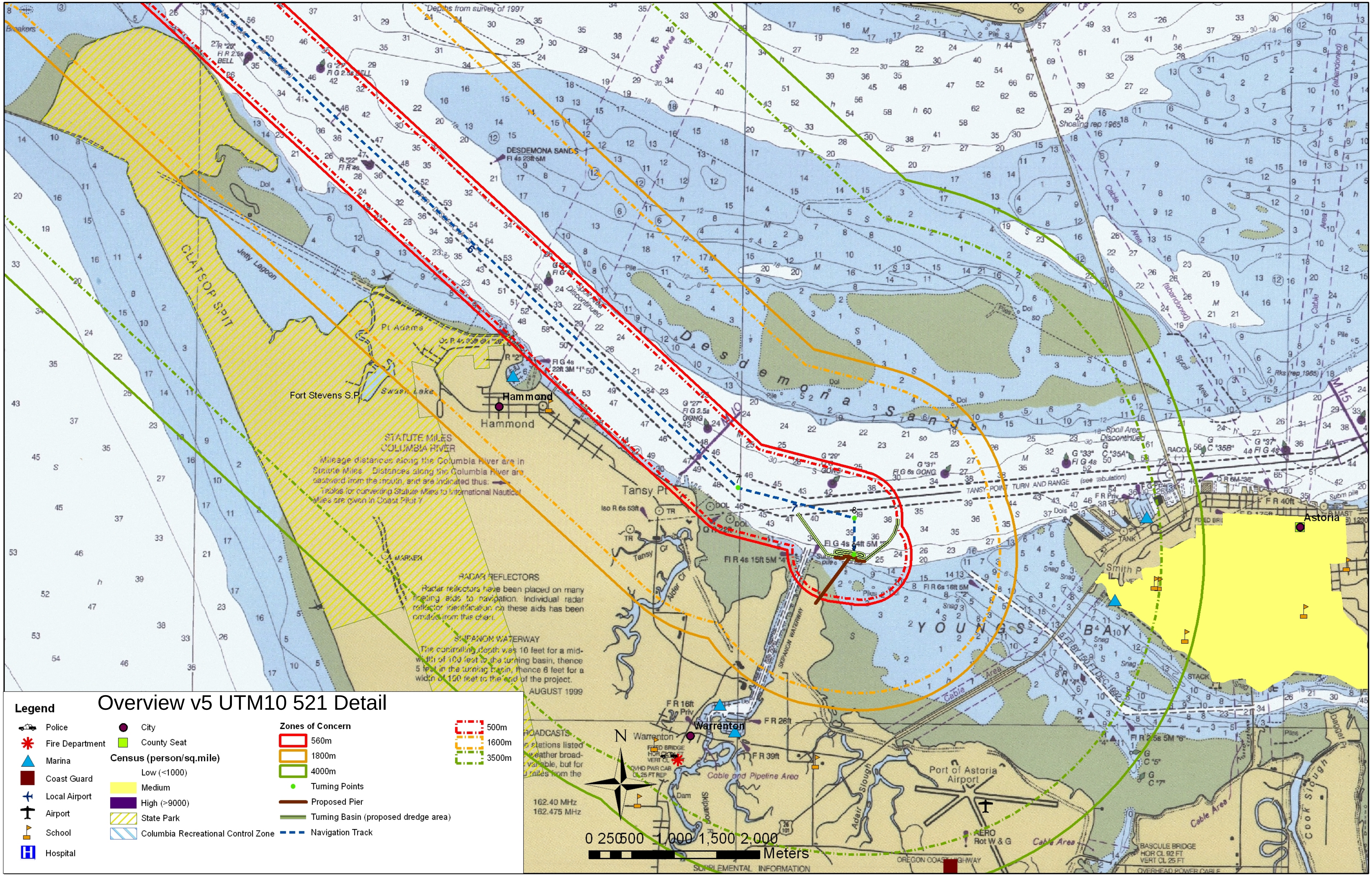
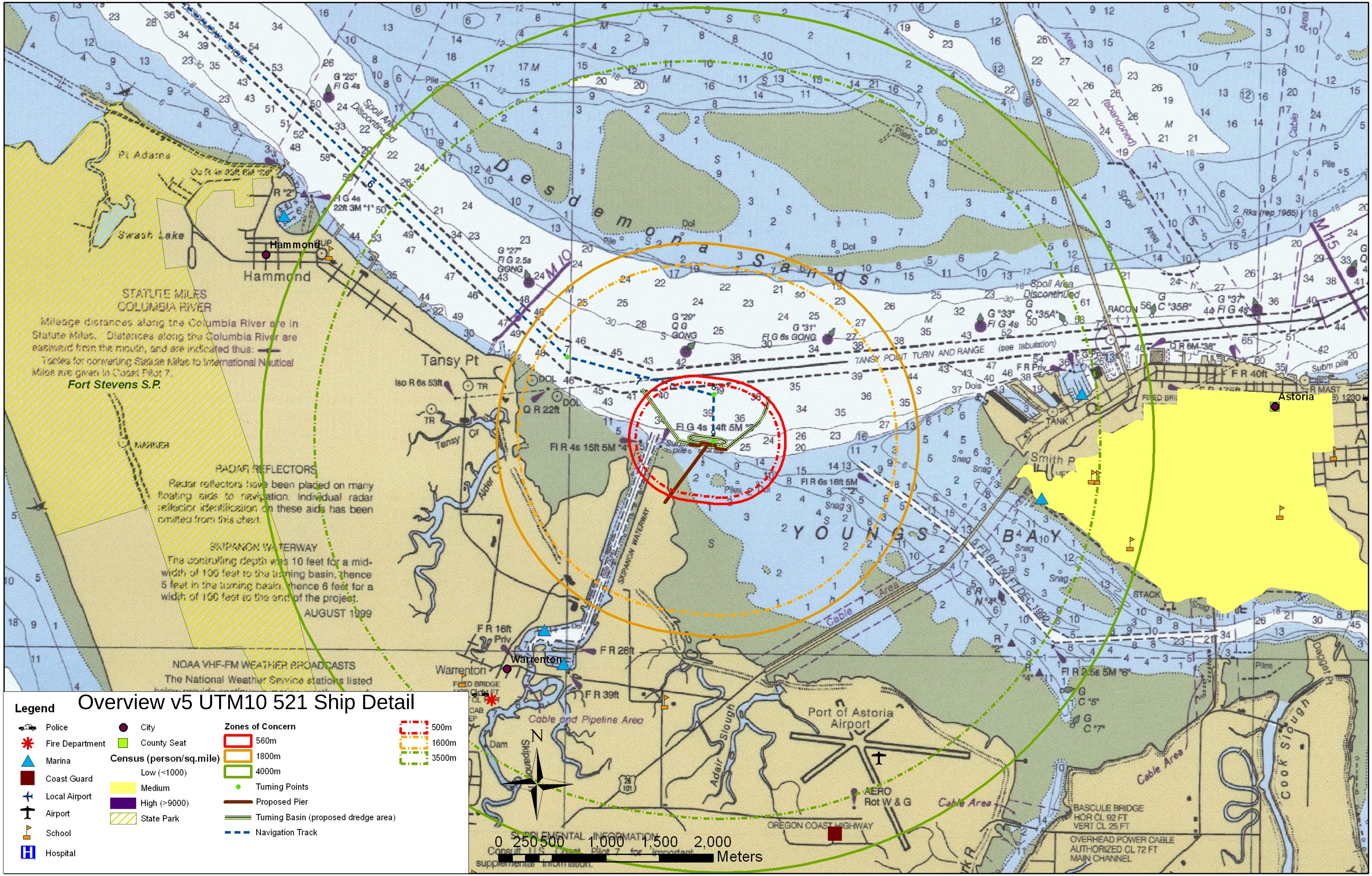
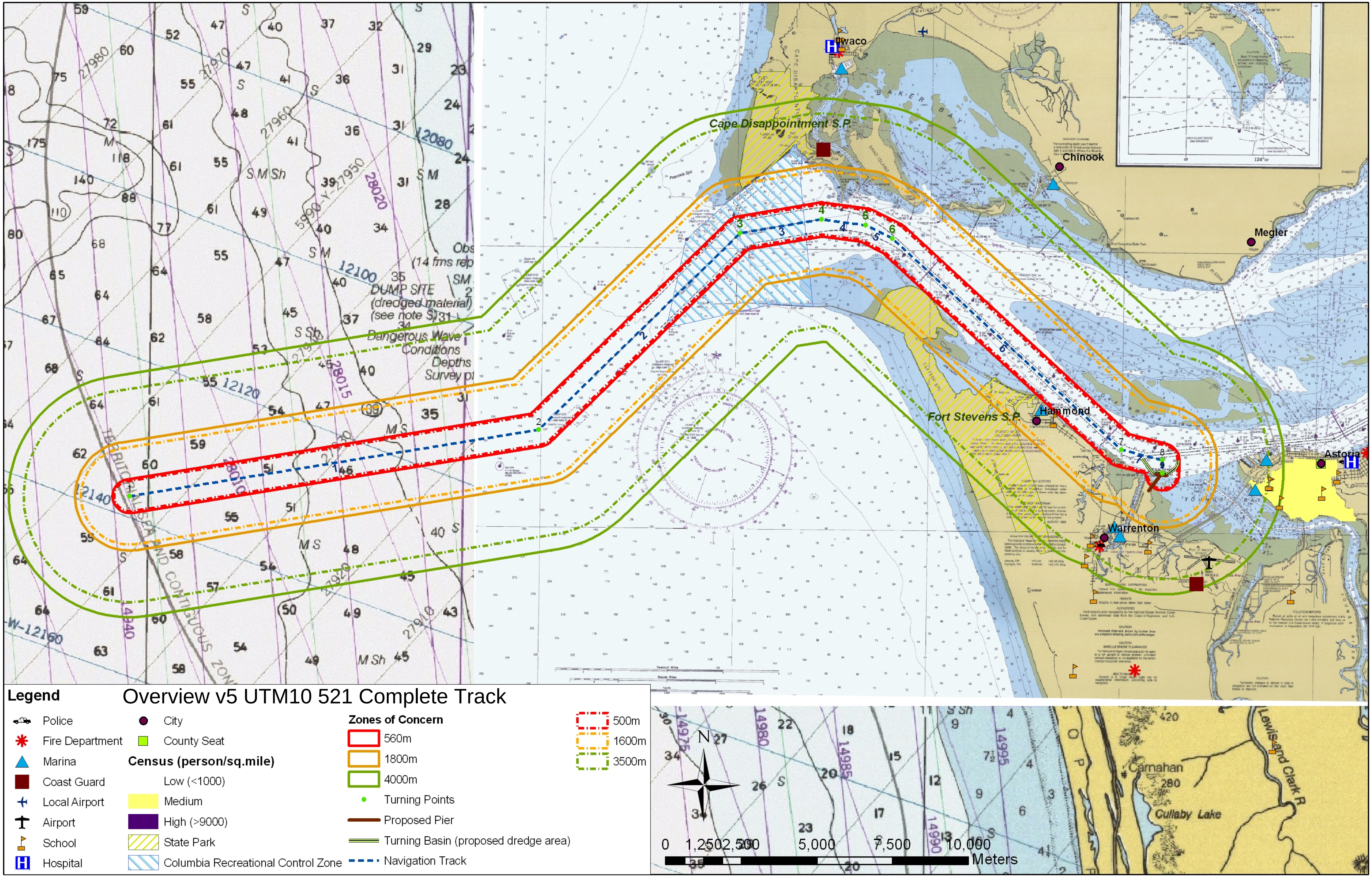

Overview v5 UTM10 521
Legend
Police
Fire Department
Marina
Coast Guard
Local Airport
Airport
School
Hospital
City
County Seat
Census (person/sq.mile)
Low (<1000)
Medium
High (>9000)
State Park
Columbia Recreational Control Zone
Zones of Concern
560m
1800m
4000m
Turning Points
Proposed Pier
Turning Basin (proposed dredge area)
Navigation Track
500m
1600m
3500m
N
0 1,250 2,500 5,000 7,500 10,000 Meters
Ilwaco
Cape Disappointment S.P.
Chinook
Megler
Hammond
Fort Stevens S.P.
Warrenton
Astoria
BAKER BAY
SAND ISLAND
Peacock Spit
Taylor Sands
Desdemona Sands
YOUNGS BAY
ANCH AREA
CLATSOP SPIT
1
2
3
4
5
6



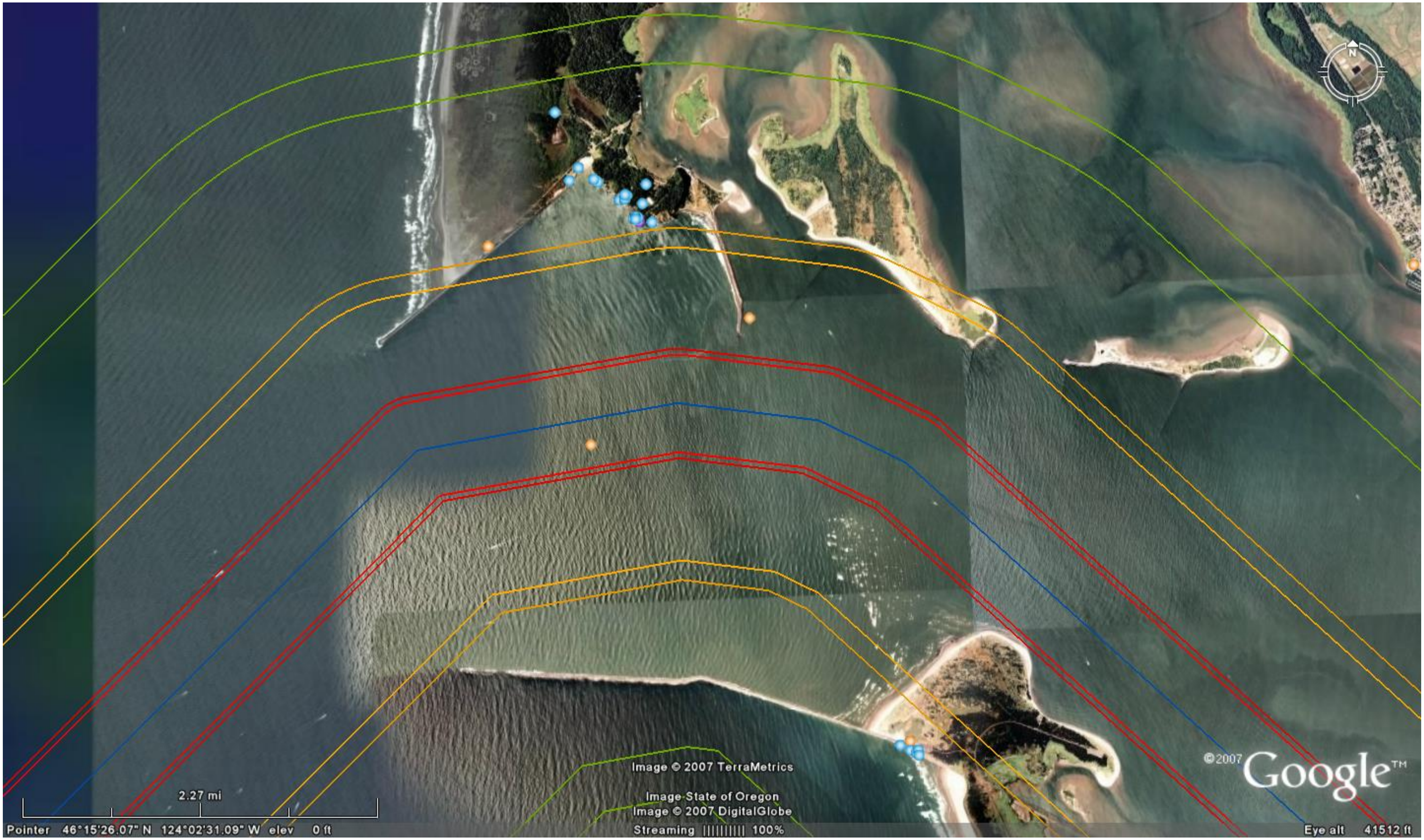
Overview v5 UTM10 521 Detail
Legend
Police
Fire Department
Marina
Coast Guard
Local Airport
Airport
School
Hospital
City
County Seat
Census (person/sq.mile)
Low (<1000)
Medium
High (>9000)
State Park
Columbia Recreational Control Zone
Zones of Concern
560m
1800m
4000m
Turning Points
Proposed Pier
Turning Basin (proposed dredge area)
Navigation Track
500m
1600m
3500m
0 250 500 1,000 1,500 2,000
Meters
N
Hammond
Warrenton
Astoria
Fort Stevens S.P.
Tansy Pt
Pt Adams
Swash Lake
Smith P
Jetty Lagoon
CLATSOP SPIT
Desdemona Sands
DESDEMONA SANDS
YOUNGS BAY
Port of Astoria Airport
Cable and Pipeline Area
Cable Area
Depths from survey of 1997
STATUTE MILES COLUMBIA RIVER
Mileage distances along the Columbia River are in Statute Miles. Distances along the Columbia River are eastward from the mouth, and are indicated thus.
Tables for converting Statute Miles to International Nautical Miles are given in Coast Pilot 7.
RADAR REFLECTORS
Radar reflectors have been placed on many floating aids to navigation. Individual radar reflector identification on these aids has been omitted from this chart.
SKIPANON WATERWAY
The controlling depth was 10 feet for a mid-width of 100 feet to the turning basin, thence 5 feet in the turning basin, thence 6 feet for a width of 150 feet to the end of the project.
AUGUST 1999
162.40 MHz
162.475 MHz
TANSY POINT TURN AND RANGE
OREGON COAST HIGHWAY
SUPPLEMENTAL INFORMATION
BASCULE BRIDGE
HOR CL 92 FT
VERT CL 25 FT
OVERHEAD POWER CABLE



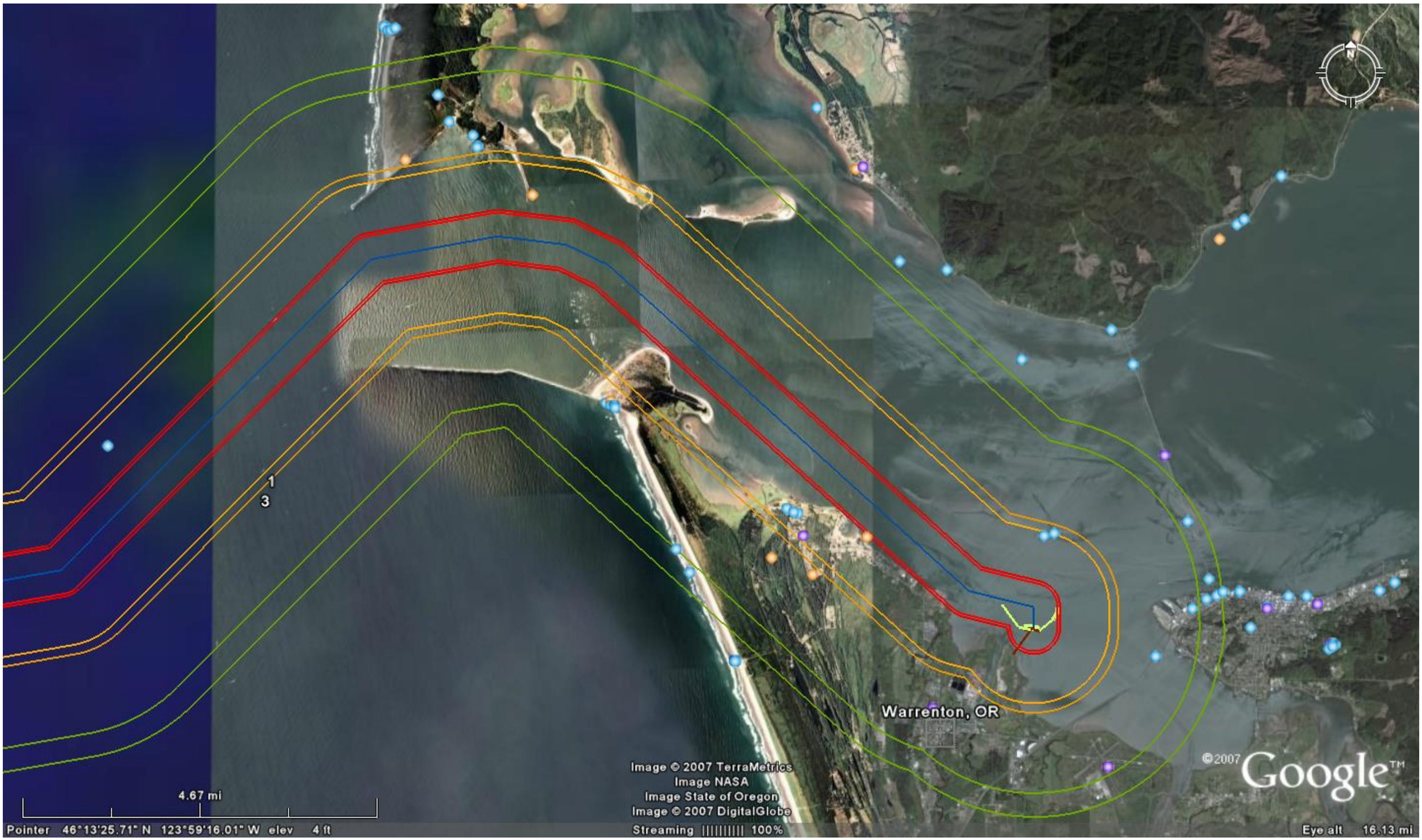
Overview v5 UTM10 521 Ship Detail
Legend
Police
Fire Department
Marina
Coast Guard
Local Airport
Airport
School
Hospital
City
County Seat
Census (person/sq.mile)
Low (<1000)
Medium
High (>9000)
State Park
Zones of Concern
560m
1800m
4000m
Turning Points
Proposed Pier
Turning Basin (proposed dredge area)
Navigation Track
500m
1600m
3500m
0 250 500 1,000 1,500 2,000
Meters
N
Desdemona Sands
YOUNGS BAY
Hammond
Astoria
Warrenton
Tansy Pt
Pt Adams
Swash Lake
Fort Stevens S.P.
Port of Astoria Airport
Smith Pt
SKIPANON WATERWAY
STATUTE MILES COLUMBIA RIVER
Mileage distances along the Columbia River are in Statute Miles. Distances along the Columbia River are eastward from the mouth, and are indicated thus:
Tables for converting Statute Miles to International Nautical Miles are given in Coast Pilot 7.
RADAR REFLECTORS
Radar reflectors have been placed on many floating aids to navigation. Individual radar reflector identification on these aids has been omitted from this chart.
SKIPANON WATERWAY
The controlling depth was 10 feet for a mid-width of 100 feet to the turning basin, thence 5 feet in the turning basin, thence 6 feet for a width of 100 feet to the end of the project.
AUGUST 1999
NOAA VHF-FM WEATHER BROADCASTS
The National Weather Service stations listed
TANSY POINT TURN AND RANGE (see tabulation)
Cable and Pipeline Area
Cable Area
OREGON COAST HIGHWAY
BASCULE BRIDGE HOR CL 92 FT VERT CL 25 FT
OVERHEAD POWER CABLE AUTHORIZED CL 72 FT MAIN CHANNEL
Spoil Area Discontinued


Overview v5 UTM10 521 Complete Track
Ilwaco
Cape Disappointment S.P.
Chinook
Megler
Hammond
Fort Stevens S.P.
Warrenton
Astoria
Carnahan
Cullaby Lake
Lewis and Clark R
DUMP SITE (dredged material) (see note S)
Dangerous Wave Conditions
Legend
Police
Fire Department
Marina
Coast Guard
Local Airport
Airport
School
Hospital
City
County Seat
Census (person/sq.mile)
Low (<1000)
Medium
High (>9000)
State Park
Columbia Recreational Control Zone
Zones of Concern
560m
1800m
4000m
500m
1600m
3500m
Turning Points
Proposed Pier
Turning Basin (proposed dredge area)
Navigation Track
N
0 1,250 2,500 5,000 7,500 10,000
Meters

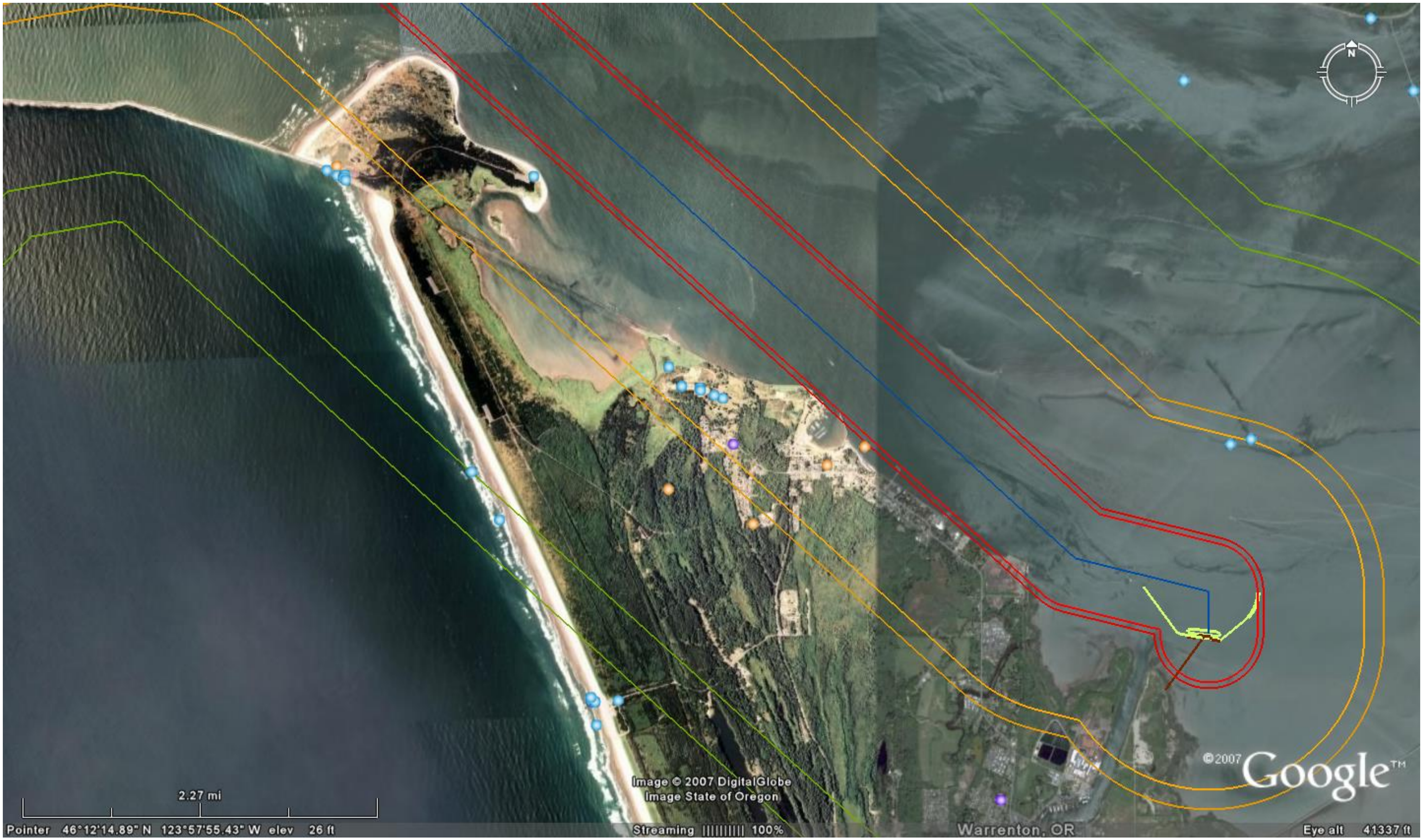
CR Bar   Track Legs 2   6



CR Buoy to Dock with ones



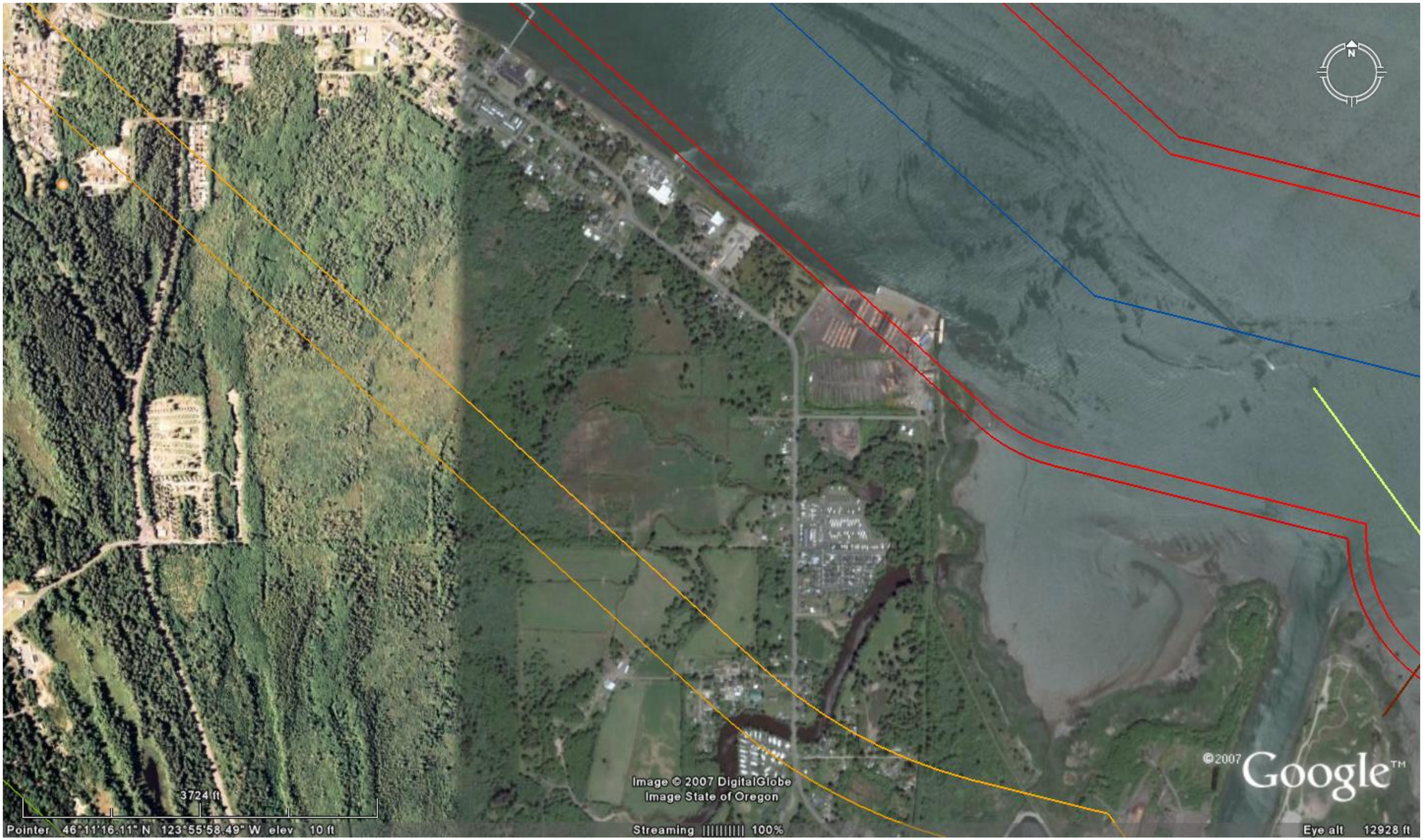
Desdemona Shoal Channel to Dock   Track Legs 6-8



Hammond Marina Area 2

Hammond Marina Overlap Closeup

Pt. Adams Packing to Tansy Pt. Area for ones 1 and 2

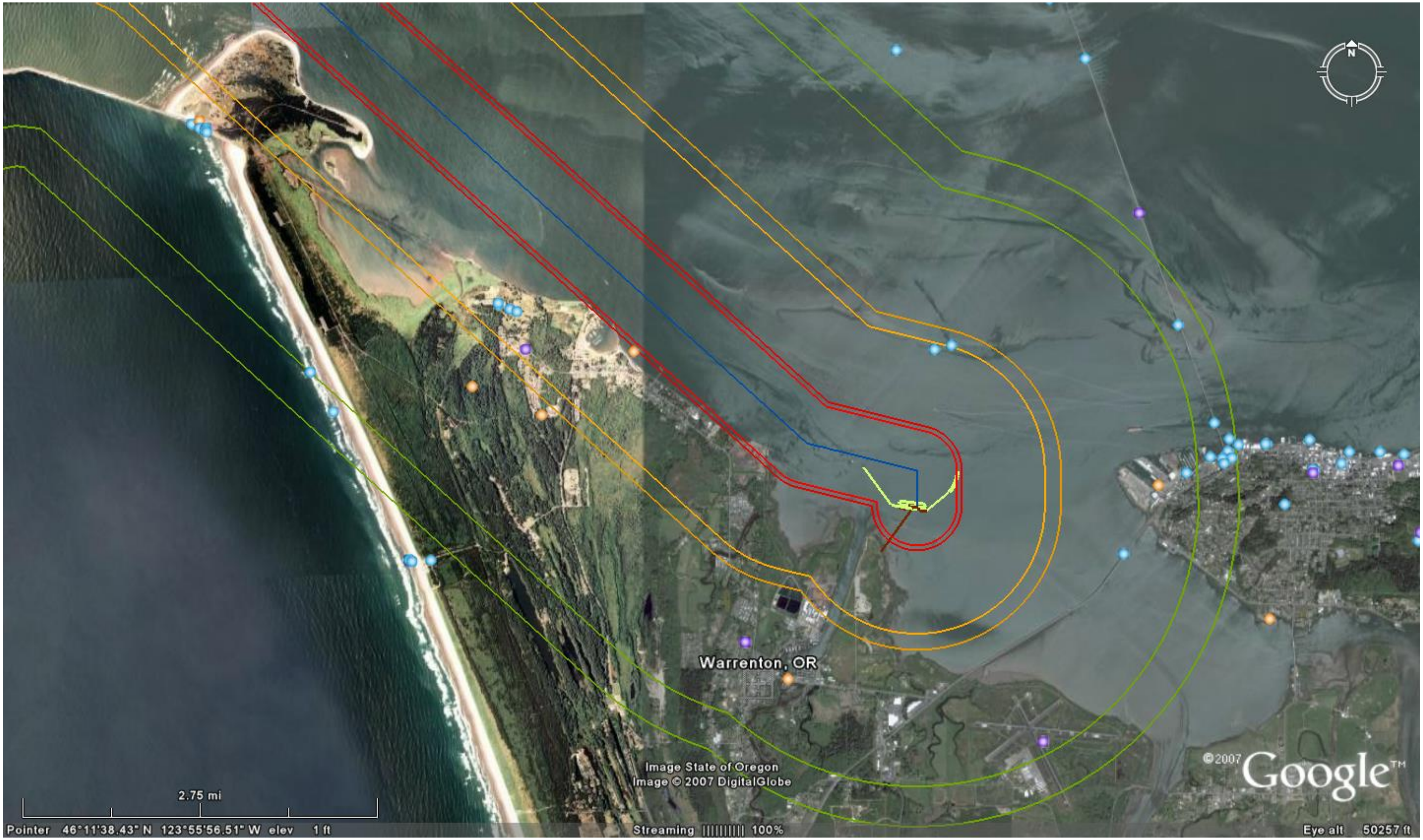


Southern Area of Ft. Stevens State Park

Warrenton Fiber and Surrounding Area

Warrenton   Astoria from Approach to Dock

Warrenton   Ft. Stevens   Astoria Overlap from Track

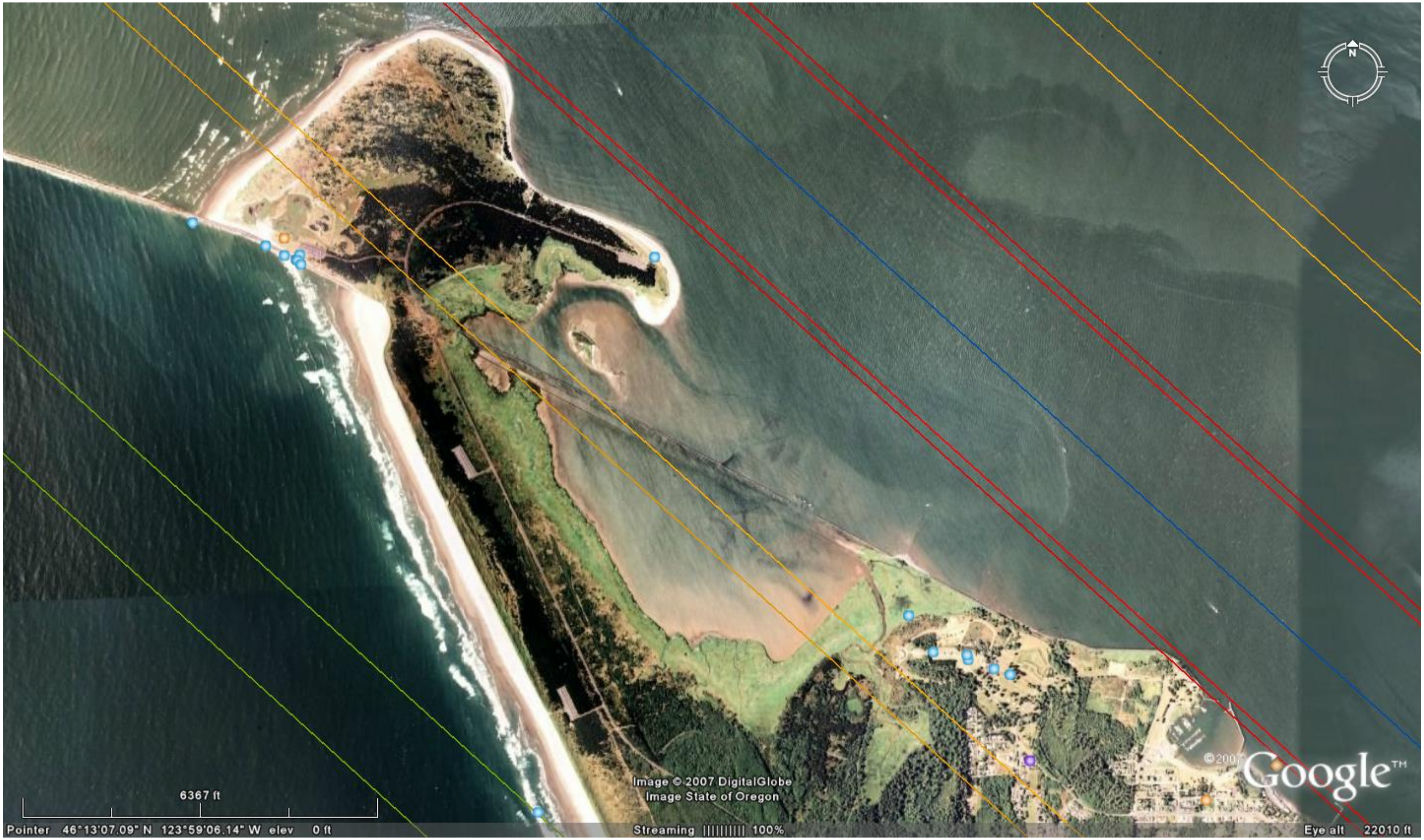


one 1 Overlap Hammond Marina to Tansy Pt.

one Overlap of Cape Disappointment State Park

one Overlap of Islands in Bakers Bay

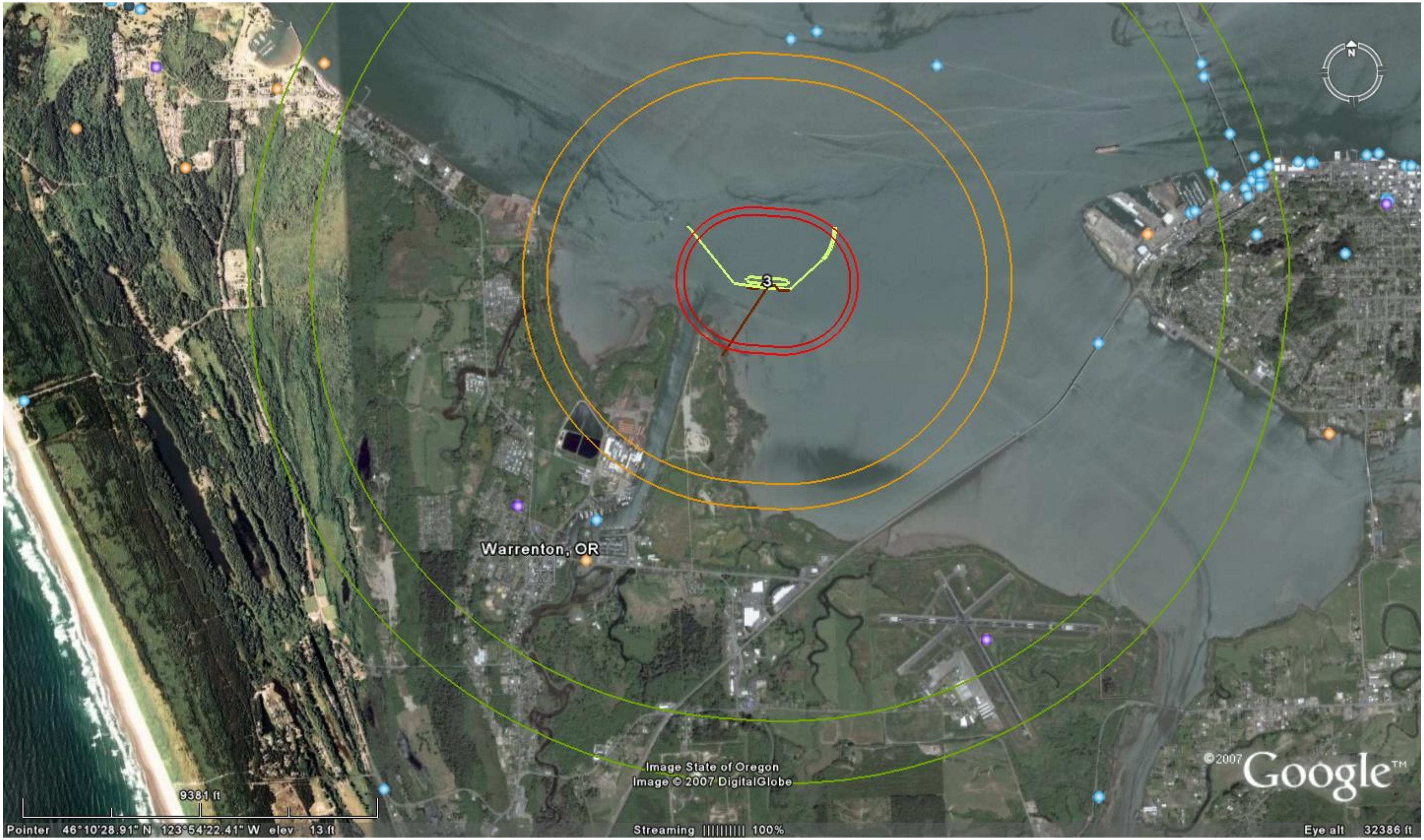
one Overlap of Northern Head of Clatsop



Ship at Dock with all   ones over Warrenton

Ship at Dock with Entire   one Overlap

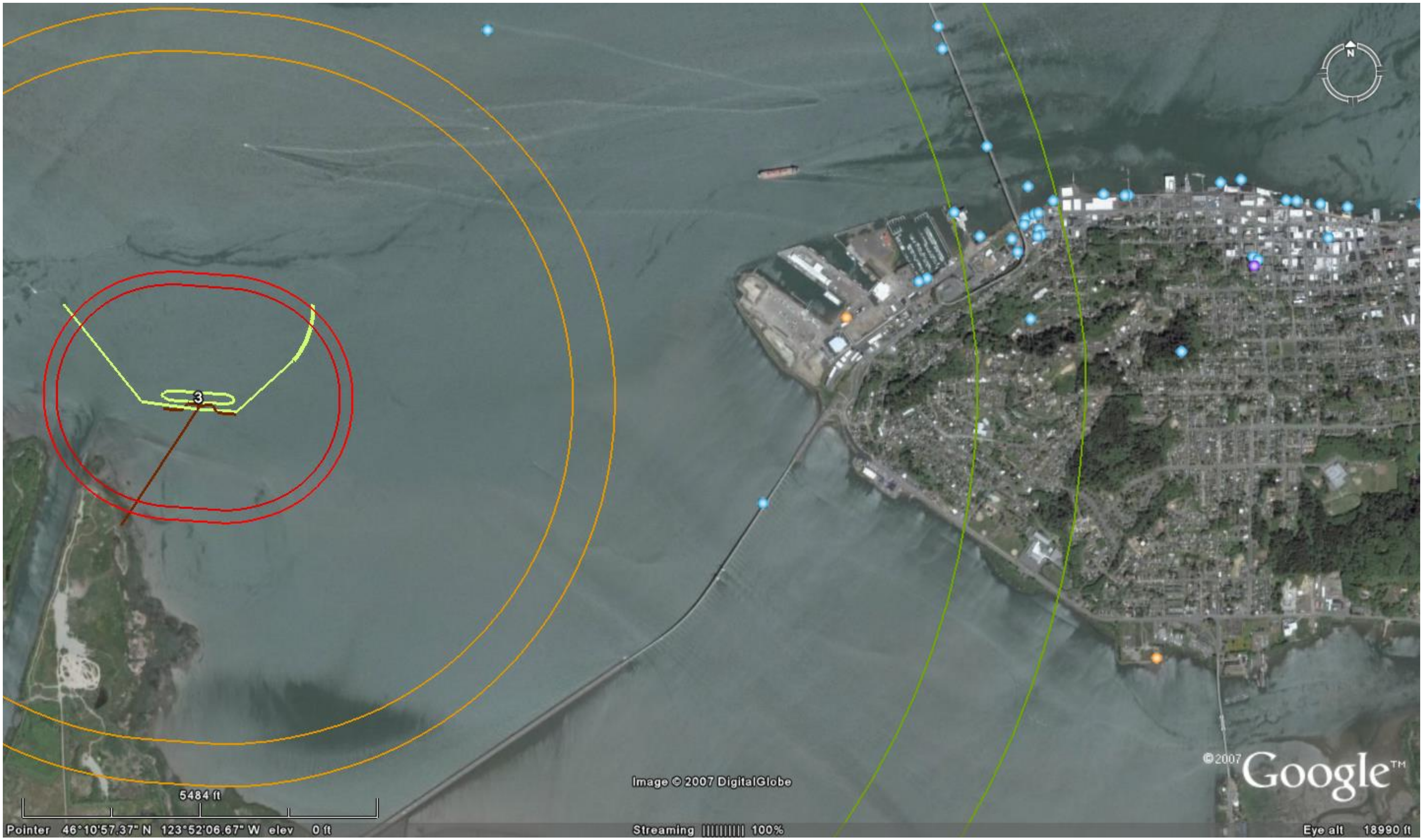
Ship at Dock with Warrenton and Astoria



Ship at Dock with   one 3 Overlap of Astoria

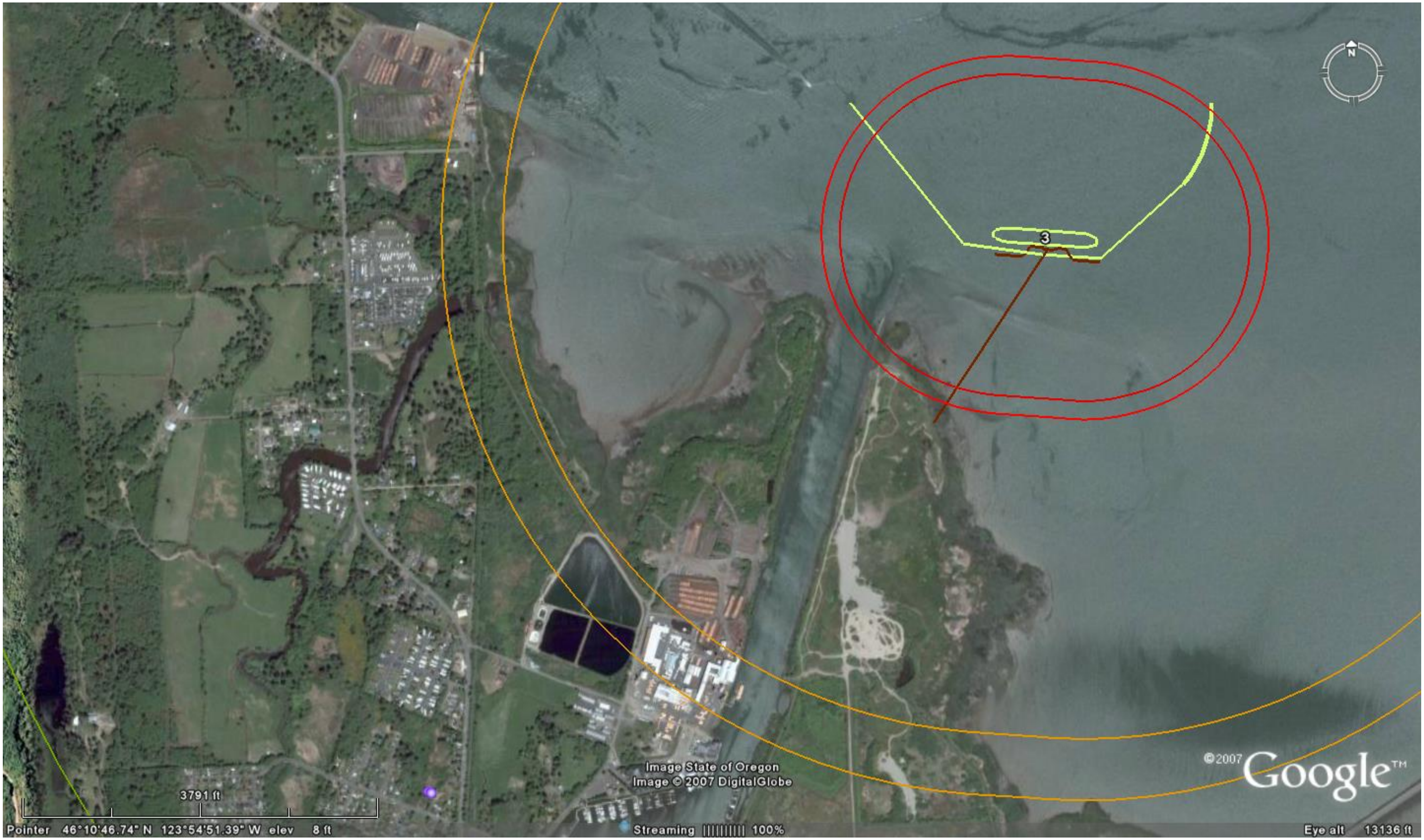
Ship at Dock with one 3 Overlap of Astoria-Meglar Bridge

Ship at Dock with one Overlap of Astoria Youngs Bay Bridge



Ship at Dock with one Overlap of Youngs Bay

Ship at Dock with ones 1 and 2 Overlap



CHANGE ANALYSIS TABLE

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
1	Additional ships transiting Lower Columbia River	Increased chance of collision and/or grounding. Increased chance of dock allisions due to more mooring evolutions. Commercial ship traffic delays in river due to increased number of vessels transiting. Potential delay of cruise ships. Additional disruption of commercial and recreational fishing. Increased activity for Bar Pilots. (Additional helicopter and pilot boat activity.) Increased requirement of CG offshore boardings (security and certificate of compliance) Increased requirement for CG port state control boardings.	Safety/security boarding conducted on CDC ships prior to entry into Columbia River. ANOA required by CG and ANE required by WA State Dept of Ecology. Pilots required aboard all LNG ships for transit and docking. River/Bar Pilots maintain awareness of ship traffic and manage ship transit activity Pilots actively monitor water level to ensure sufficient water under keel prior to bringing ships over bar and in river. Bar closure provisions and/or suspension of service provisions in place for hazardous conditions. Sufficient aids to navigation to facilitate safe navigation Port State Control boardings conducted to monitor/enforce safety/security standards (including STCW)	Active management of vsl traffic by Columbia Bar & River Pilots to minimize delays and avoid meeting situations of the larger commercial vessel in the Desdemona Shoals Channel. Manage LNG vessel arrivals to avoid disruption of Buoy 10 fishing season (ie consider only permitting entry in late afternoon/evening when fishing activity typically lessens or after dark) Offshore safety boardings if certificate of compliance expired Install new visual/fixed aid to nav for Desdemona Channel Use of the larger class Q-Max ships would reduce number of ship visits necessary for terminal

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
2	Larger ships/New class of ships	Increased chance of grounding due to increased size of ships and new handling characteristics of ships. Wider beams on new ships may require increase risk of collision accident if conducting meeting situations in relatively narrow Desdemona Channel. Increased chance of dock allisions as pilots familiarize themselves with new ship characteristics and mooring techniques. Chance of ship being blown off dock in high winds. Dredging and continuing maintenance dredging required for turning basin and approach to dock.	CR ship channel now maintained to control depth of 43' in transit area by COE Ships highly regulated and required to have double bottoms, specific fire fighting equipment, electronic sensor & control systems (radar, AIS, radios, etc), safety equipment, redundant propulsion, steering, and auxiliary equipment. Ships are required to certify that their equipment is operating properly prior to entry into Columbia River. Pilots ensure state of tide provides adequate water under keel prior to bringing ships into river system	Simulator training for CR Bar pilots on new ship characteristics entering,/transiting river and docking procedures. Tugs should meet ships in Bar area depending on weather conditions to escort inbound ships providing immediate assistance on scene. Establish policy limiting meeting situations with inbound LNG ships. Establish policy to restrict bunkering ships in port Establish policy setting wind limitations when ship must stop cargo transfer and get underway or restricted from entering port. Establish policy restricting entry to river by LNG ships if visibility is below certain limit. Install new visual/fixed aid to navigation for Desdemona Channel Pilots suggest acquiring dynamic under keel clearance system

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
3	Introduction of LNG cargo by ship	Risk of cargo tank breach with release of cargo from accidental or intentional action which brings fire threat potential. Will require establishment/ implementation of safety/security zone around ships which in turn may cause: • Disruption to recreational & fishing vessels operating near channels. • One-way commercial ship traffic in Desdemona Shoal Channel. • Requirement for escort boats to enforce zone. Increased fire threat creates potential for overwhelming capability of Astoria Hospital that does not have a burn center. Increased fire threat creates potential need for air ambulance services since hospital not equipped for burn victims.	LNG ship crewmembers required to have specific training for their ships. Sector Portland Port Guidelines for COTP Zone addresses: • Requirements for tank vessels to conduct propulsion test prior to entry into US waters. • Basic boarding policies. • Anchoring offshore. Sector Portland has stated that LNG ships and cruise ships will not meet in ship channel in WSR for Bradwood. MFSA is standing cooperative organization between deep ports along CR to respond to maritime incident. Astoria is a member ,but does not include Warrenton.	Establish security zones around LNG ships when carrying cargo above their heel Require armed security boat escorts of loaded ships entering port to enforce security zone. Require sufficient tug support to escort ship from Sand Island Range Channel to terminal. Ensure tugs have ire fighting capability. Manage vessel traffic to avoid or minimize meeting situations of large commercial ships in Desdemona Shoal Channel. Manage LNG vessel arrivals to avoid disruption of Buoy 10 fishing season (i.e. consider only permitting entry in evening or night) Warrenton Fire Department will need training for LNG fires and shipboard fire fighting support. Port Guidelines need to address LNG Ops or create specific LNG Ops Plan/Vessel Transit Plan for the C R outlining vessel traffic management requirements, weather restrictions for transit and cargo transfer, boarding procedures, escort procedures, tug use and standby requirements, limitations on bunkering & provisioning, emergency warning procedures, etc

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies: Existing Prevention Policies/Practices/Requirements	Risk Control Strategies: Recommended Additional Requirements
4	New LNG Facility in port	Deep draft vessel activity in area where there was not before – potential for allisions and grounding while approaching/departing dock. New tug and security vessel activity in area. Establishment of fixed security zone may restrict vessel movement entering or leaving Skipanon Waterway, depending on size of zone. Possible delay of ships transiting CR while LNG vsl maneuvered out of ship channel and turned around for mooring. May require transit speed to be lowered by commercial ships passing the terminal to avoid creating wake/surge/suction for ships offloading at dock. Potential allision with LNG ship moored at facility or with dock by other ships transiting inbound approaching Tansy Pt turn if they experience steering or propulsion casualties or if pilots misjudge turn and "swing wide" at Tansy Pt turn.	Security plan requirements from MTSA/ISPS will apply for terminal.	Determine need for new or additional ATON to ensure channel turn is better marked to decrease chance of nav error at Tansy Pt turn. Establish a fixed security zone around facility when ships moored Require waterside security patrol while ship is moored. Require tug on immediate standby while LNG ship moored. Require tug underway near ship channel when commercial ships passing to provide assistance if propulsion or steering failures. Examine potential for accidental collision by transiting ship with dock/moored LNG ship on simulator. Establish no passing policy in vicinity of Tansy Point Turn. Establish speed restrictions of large ships passing facility to minimize surge.

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
5	Cargo transfer activity at facility	Risk of break in connection due to system failure. Risk of break in connection due to human error. Weather/Wind may cause vsl to shift and break connection. Risk of break in connection due to surge of passing ships.	Existing equipment safety standards provide automatic cut off valves if there is a break. Existing standards for transfer personnel to actively monitor all transfer operations so that they can shut transfer valves if the automatic system fails. Requirement exists within CG regs for inspection and monitoring of cargo transfer ops.	Develop emergency response plan. COTP establish inspection & cargo transfer monitoring standards for facility. Establish comms /notification policy with COTP when conducting cargo transfer if not CG observers on scene. Ensure emergency disconnect gear installed/working properly. Install gas detection meters IAW regulations. Establish policy/standards for standby tugs, weather/wind limts for conducting cargo transfers and movement of ship from dock. Recommend tension gauges on mooring lines to indicate potential breaking point. Enforce training, quals & standards for facility personnel. Establishing speed restrictions of large ships passing facility in shipping channel to reduce surge.

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
6	Increased tug activity	Anticipate requirement for 3-4 tugs for LNG ship operations at terminal. Additional risk of collision. Impact on recreational boaters using area adjacent to facility and along Desdemona Channel as tugs proceed to escorts.	Standard rules of the road apply to ensure safe operations.	Ensure tug crews adequately trained for handling new class of ships and familiar with area. Two tugs should meet and escort inbound LNG ships from CR Bar to dock. Remaining tugs needed for docking maneuver to meet inbound ship in Upper Desdemona. Tugs should be equipped and trained with full fire fighting capability. To reduce risk and be able to provide immediate response to steering/propulsion failure of passing large commercial ships, at least one tug should be underway to escort them past facility dock. Ensure tug captains appreciate need to operate courteously in vicinity of small boats.

Lower Columbia River and Approach Accidental Mishaps											
Scenario Description and Recommendation					Risk Score				Revised Risk Score		
What If	Cause	Locations	Consequences	Existing Safeguards	Probability (Historical)	Consequence	Risk	Recommendations	Probability	Consequence	Risk
Grounding	1. System failures: steering, propulsion, or nav systems 2. Pilot error 3. Crew error 4. Other vessel error	**Departure from Track line 1** (Ship will not ground if on track line. Assume something caused variance from track. **All posits are at 3 ft depth line.)**		Double hull construction Redundant ship propulsion and steering systems							
		South side of Columbia River south jetty – approx 2500yds (2378m) off Clatsop Spit at 30ft line	**Rock etty Potential breach one 3 Low population**	Safety/Security Boarding prior to entering Columbia River to ensure equipment aboard is working properly.	1	1	1	Two tugs will meet/escort inbound loaded LNG ships in vicinity of the Bar to escort to turning basin, and	1	1	1
		Posit 1500 yds (1372m) off shoreline W of Warrenton	**No breach** - Sandy beach (Within Zone 2 of shore however no breach expected)	Redundant ground tackle systems for anchoring Compulsory Pilotage	1	N A	N A	Establish weather parameters for LNG ships entering port (wind speed, visibility, etc), and Shiphandling training for pilots for the new class of ships, and	1	N A	N A
		Departure from track leg 2		Bar Pilots ensure proper state of tide/ adequate water under keel prior to scheduling entry to river				Certificate of Compliance inspections completed dockside as required or at sea if certificate expired.			
		Position 1300 yds (1189m) off shoreline W of Seaview	**No breach** - Sandy beach (Within Zone 2 of shore however no breach expected)	Existing regulations for the CG to close the CR bar if weather becomes extreme	1	N A	N A		1	N A	N A
		North jetty inside mouth on western tip of Cape Disappointment State Park.	**Rock etty Potential breach one 1 2 3 Low pop**	Existing practice of Bar Pilots to suspend service and hold ships outside when weather conditions do not permit boarding	2	1	2	Establish an Emergency Alert System in the Park, or	1	1	1
			one 1 2 3 - Medium pop in summer		2	3	6	Establish policy mandating night transits during the busy summer season.	1	1	1
		On submerged part of S jetty approx 4600yds (4206m) west of Clatsop Spit and 4200yds (3840m) S of west tip of Cape Disappointment State Park	**Rock etty Potential breach one 3 - Low population** (Recognize the Park may have medium population in summer, but did not considered the 160m overlap of the sandy tip of land to have enough people to be considered medium population).	Practice of submitting ANOA/ANE declaring proper operation of equipment	2	1	2		1	1	1

Lower Columbia River and Approach Accidental Mishaps											
Scenario Description and Recommendation					Risk Score				Revised Risk Score		
What If	Cause	Locations	Consequences	Existing Safeguards	Probability (Historical)	Consequence	Risk	Recommendations	Probability	Consequence	Risk
Grounding	1. System failures: steering and/or main propulsion 2. Pilot error 3. Crew error (Will not occur if ship is on track line. Requires something to cause ship to veer from course.)	**Departure from Track legs 3 4**									
		Posit 800 yds (732m) off Cape Disappointment visitors center	No breach		2	N A	N A		1	N A	N A
		Posit 2600 yds (2377m) S of Chinook marina	No breach		2	N A	N A		1	N A	N A
		Posit 1400 yds (1280m) N of Clatsop Spit (Since no breach does not require action to avoid high density boating of Buoy 10)	No breach		2	N A	N A		1	N A	N A
		Departure fromTrack leg 6									
		Posit 150 yds (137m) off Hammond marina	No breach		2	N A	N A		1	N A	N A
		Posit 100 yds (92m) off Pt Triumph Condos (Hammond)	No breach		2	N A	N A		1	N A	N A
		Allide with Pt Adams Packing pier	No breach		2	N A	N A		1	N A	N A
		Allide with Nygard Dock	No breach		2	N A	N A		1	N A	N A
		Track leg 7									
		Posit up river from terminal/700 yds (640m) off Pier III/ Haul Out Boatyard - Astoria	No breach		2	N A	N A		1	N A	N A

Lower Columbia River and Approach Accidental Mishaps											
Scenario Description and Recommendation					Risk Score				Revised Risk Score		
What If	Cause	Locations	Consequences	Existing Safeguards	Probability (Historical)	Consequence	Risk	Recommendations	Probability	Consequence	Risk
Low Speed Collision. Assume incident would occur while ship is on track line.	1. System failures: steering and/or main propulsion 2. Pilot error 3. Crew error 4. Other vessel error	Anywhere along track. Assume ship is on track at time of collision.	Minor damage to ships No breach	Double hull Redundant ship propulsion and steering systems Safety/Security Boarding prior to entering Columbia River to ensure equipment aboard is working properly before entering the River Compulsory Pilotage Provision to close bar if weather presents hazardous conditions by Coast Guard or suspend service by pilots Automatic Identification System (AIS) installed	1	N A	N A	None needed for this scenario	1	N A	N A

Lower Columbia River and Approach Accidental Mishaps											
Scenario Description and Recommendation					Risk Score				Revised Risk Score		
What If	Cause	Locations	Consequences	Existing Safeguards	Probability (Historical)	Consequence	Risk	Recommendations	Probability	Consequence	Risk
High Speed Collision (>7kts – large ship)	1. System failures: steering and/or main propulsion 2. Pilot error 3. Crew error	Assume ship is on track line at time of incident.	High speed collision (>7kts) with another large ship (> 50K GT) at near right angle will penetrate cargo tank and may cause breach with small to medium spill**.**	Double hull Redundant shipboard systems to ensure power not lost and steering not lost							
		Along Entrance Range Channel (Track leg 2) The end of track leg 2 inbound ship approaches land of Cape Disappointment to witin 1200 yds (1097m) of the tip of the jetty. Point of land at Cape Disappointment is 1600 yds (1463m) from nearest point on track leg.	**one 2 3 - Low population**	Safety/Security Boarding prior to entering Columbia River to ensure equipment aboard is working properly before entering the River	**1**	**1**	**1**	Shiphandling training for pilots for the new class of ships	**1**	**1**	**1**
			one 2 - Low pop one 3 - Med pop (summer)		**1**	**1**	**1**	Tugs meet/escort inbound ships. At least one tethered.	**1**	**1**	**1**
		Along Sand Island Range Channel and turn to Desdemona (Track legs 3 4)		Compulsory Pilotage Bar pilots practice of suspending service if weather conditions unsafe.				Publish policy standards for permitting ship entry into river based on weather parameters (Visibility, wind speed, bar condition) Establish vessel traffic management policy restricting meeting/passing situations of large ships with inbound/loaded LNG tankers.			
		Posit where ship passes 750 yds (686m) south of Jetty A	**one 2 3- Low pop**	Provision to close bar if weather presents hazardous conditions (CG)	**1**	**1**	**1**		**1**	**1**	**1**
			one 1 2 Medium pop during busiest fishing seasons (une Sept)	Automatic Identification System (AIS) installed.	**1**	**3**	**3**	Establish policy for night transits of LNG vessels during Busiest Fishing Seasons.	**1**	**1**	**1**
		Position where ship passes 1400yds (1280m) southwest of Sand Island and 1700 yds (1555m) north of north tip of Clatsop Spit	**one 2 3 - Low pop**		**1**	**1**	**1**		**1**	**1**	**1**

Lower Columbia River and Approach Accidental Mishaps											
Scenario Description and Recommendation					Risk Score				Revised Risk Score		
What If	Cause	Locations	Consequences	Existing Safeguards	Probability (Historical)	Consequence	Risk	Recommendations	Probability	Consequence	Risk
High Speed Collision (>7kts – large ship)	1. System failures: steering and/or main propulsion 2. Pilot error 3. Crew error	**Along Lower Upper Desdemona Shoal Channel Tansy Pt turn (Track leg 6 half of 7)**									
		Passes 650 yds (595m) east of Clatsop Spit	**one 2 3 - Low pop**		**1**	**1**	**1**		**1**	**1**	**1**
		Passes 600yds (549m) east of point by Hammond Marina	**one 1 2 3 - Low pop**		**1**	**1**	**1**		**1**	**1**	**1**
			one 1 - Low pop one 2 3 - Medium population (summer)		**1**	**2**	**2**		**1**	**2**	**2**
		Passes 400yds (366m) east of Tansy Pt (Nygard Docks)	**one 1 2 3 Low pop**		**1**	**1**	**1**		**1**	**1**	**1**
			one 1 - Low pop one 2 3 - Medium pop (summer)		**1**	**2**	**2**		**1**	**2**	**2**
		Along track leg 7 8 traversing Tansy Pt turn and through turning basin									
		Midpoint of track leg 7 passes 950 yds (869m) north of western Skipanon peninsula and is within 4000m of residential area of Astoria	**one 2 - Low pop one 3 - Medium pop**		**1**	**1**	**1**		**1**	**1**	**1**

Lower Columbia River and Approach Accidental Mishaps											
Scenario Description and Recommendation					Risk Score				Revised Risk Score		
What If	Cause	Locations	Consequences	Existing Safeguards	Probability (Historical)	Consequence	Risk	Recommendations	Probability	Consequence	Risk
Allision with dock while mooring LNG ship	1. System failures: Main prop 2. Pilot error 3. Tug error 4. Weather	Skipanon Facility Site	Minor damage to ship No breach	Adequate tug support to maneuver ship and provide redundancy	1	N A	N A	Establish policy with weather parameters which permit/prohibit mooring ship (ie vessel shall not moor when winds exceed a certain speed) Training for pilots and tug operators	1	N A	N A
Cargo Handling Mishap	1. System failure 2. Operator error 3. Surge from passing ships 4. Weather (winds, lightning) 5. Earthquake	Skipanon Facility	Localized fire or vapor release. Zones of concern not applicable since does not involve breach of ship cargo tank.	Auto shut-off valves Remote manual shutdown valves Existing regulations for training qualifications for personnel involved in cargo transfer Existing federal regulations for CG inspection of LNG facilities (33CFR127) Existing regulations for the CG COTP to monitor cargo transfer ops	1	1	1	Establish limitations on cargo operations based on wind speed (for example: halt cargo transfer ops if wind speed in excess of 30kts continuous) Establish policy for cargo transfer inspections/monitors.	1	1	1

Lower Columbia River and Approach Accidental Mishaps											
Scenario Description and Recommendation					Risk Score				Revised Risk Score		
What If	Cause	Locations	Consequences	Existing Safeguards	Probability (Historical)	Consequence	Risk	Recommendations	Probability	Consequence	Risk
High Speed Allision with moored LNG ship by large commercial ship	1. System failures: Main prop Steering 2. Pilot error	Skipanon Facility Site	Potential breach **one 1 2 - Low pop** **one 3 - Med pop**	Compulsory Pilotage for large commercial ship Regulation of requiring testing steering, propulsion, and anchors prior to entry into U.S. ports (33CFR160/164.35) Practice of maintaining anchors ready for letting go	**1**	**1**	**1**	Establish requirement for tugs to escort large ships passing facility (>50,000GT)	**1**	**1**	**1**
LNG ship breaks moorings at dock	1. Surge from passing ship 2. Extreme wind gust 3. Tsunami effect	Skipanon Facility	May cause ship to go aground and/or may cause minor release of cargo if in process of cargo handling.	Mooring line configuration will be designed to hold ship securely at the dock for winds up to 56kts.	**1**	**N A**	**N A**	Establish a policy to either get underway or take additional positive actions if the wind exceeds a certain continuous wind speed. (ie. if winds exceed 56 kts, the facility will take positive measures to hold ship against the pier such as tug assistance; ship should have engines warmed up/on line for quick response; pilot on standby or on scene)	**1**	**N A**	**N A**
				Study conducted by Oregon LNG indicates the dock design is adequate for ship to remain securely moored to pier if a surge occurs from a Tsunami and the pier will be dredged to 50 feet so a ship will not “bottom out” with expected suction effect.				Establish tug stand by policy when LNG ships at the dock.			

Lower Columbia River and Approach Accidental Mishaps											
Scenario Description and Recommendation					Risk Score				Revised Risk Score		
What If	Cause	Locations	Consequences	Existing Safeguards	Probability (Historical)	Consequence	Risk	Recommendations	Probability	Consequence	Risk
Small aircraft crashes on ship at dock	1. Pilot error 2. Mechanical failure	Skipanon Facility Dock	May cause breach of upper tank with a localized fire. Zone of concern would not apply.	Double hull of ship would withstand impact of light aircraft without cargo tank breach. May damage top of tank. May cause fire on vessel but would not create a large LNG spill/pool fire of the magnitude addressed in the Sandia study.	1	1	1	Tugs remain on scene in immediate standby equipped with fire fighting equipment. Ships are equipped with firefighting equipment and crews are trained in response.	1	1	1

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Surface Attack	Small Boat Attack (Cole Type small boat Scenario)	Along entire track leg 1 and along track leg 2 to position abeam of Lighted Buoy 4	Breach along this offshore leg of the track line towards the Columbia River mouth is beyond any zone of concern touching land. Nearest point of land is 4400yds (4023m) from outer tip of south jetty , 4850yds (4435m) from outer most tip off south jetty, and 5700yds (5212m) from actual nearest point of land which is western tip of Cape Disappointment State Park. **No one of concern overlap with land**	Double hull Distance offshore Open ocean steaming at sea speed Periodic air surveillance of area					Conduct security boardings prior to ship entry into River.									Increase frequency of security boardings with additional CG unit presence.									Air patrol in advance of ship heading towards River mouth.				
				Existing boating awareness programs to look for and report unusual/suspicious activity in waterfront areas – Americas Waterway Watch Program (Coast Watch)	1	3			Facility tugs should be on immediate standby once the pilot embarks and ship starts inbound transit and get underway in time to meet ship between buoys	1	2			2	2			Increase air and surface patrols of area to enhance MDA.	2	2			3	2			Small boat escort to begin at CR Bouy, weather permitting.	3	2		
				Routine CG practice of conducting periodic air and surface harbor patrols to maintain Maritime Domain Awareness Routine enforcement patrols by OSPD, WDFW, and CG units conducting fisheries enforcement offshore all contributes to MDA and deterrence for anyone planning a boat and/or stand off weapon attack from a boat. Pilot aboard able to communicate/alert enforcement agencies if there is unusual boating activity.																													
		Along track leg 2, from buoy 4, track leg 3, track leg 4, and 5.	Ships following these track legs transit within 1200 yds (1097m) of the north jetty 1600yds (1463m) of the southernmost tip off Cape Disappointment and 700 yds (640m) of Jetty A the end of this track segment approaches to 1800 yds (1646m) of northern tip of Clatsop Spit and 1400 yds (1280m) off southern end of Sand Is. Breach of cargo tank while ship is on this part of the track line will result in following zone of concern overlaps:	Double hull					Establish 500 yard safety/security zone around inbound/loaded LNG tankers extending from the CR Buoy to the dock.									Increase air and surface patrols of area to enhance MDA.									Conduct air and surface patrol of transit route in advance of arriving ship.				
			one 2 3 Low population (north etty etty A southern tip of Sand Island and approx 2 yds of northern tip of Clatsop Spit).	Existing boating awareness programs to look for and report unusual/suspicious activity in marinas, boat ramps and other waterfront areas – Americas Waterway Watch Program (Coast Watch)	1	4	1	4	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent).	1	3	1	3	2	3	1	6	Enforce strict 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.	2	2	1	4	3	2	1	6	Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.	3	1	1	3
			Seasonal Cape Disappointment State Park will surge to about 5000 people in a day during summer season. Ft Stevens State Park also increases in the number of people, but main concentration is south of Jetty Lagoon. **Small one 2 overlap of Low populatio**n. **one 3 - Medium population (une through early Sept)**	CG conducts periodic air and surface harbor patrols and other missions in the area that contribute to maintaining Maritime Domain Awareness and providing a level of deterrence. (MDA)	1	4	1	4	Harbor patrols to be conducted periodically.	1	3	1	3	2	3	1	6		2	2	1	4	3	2	1	6	Conduct armed air escort during ship transit inbound coordinating with surface escort boats.	3	1	1	3
			Seasonal The area along track legs 3, 4, & 5 could have very high density boating density during Buoy 10 fishing season in September. May have concentrations of 2K boats in a confined area. **one 1 Medium population (une - Sept)**	Routine enforcement patrols by OSPD and WDFW also contributes to MDA and deterrence	1	4	3	12	Establish policy mandating night transits during the busiest fishing seasons.	1	3	1	3	2	3	1	6		2	2	1	4	3	2	1	6	Close marinas down river of Astoria-Meglar Bridge to outgoing boat traffic one hour prior to ship arrival at Bar.	3	1	1	3
																		Establish policy mandating night transits during the busiest fishing seasons.									CG MSST/qualified LE Team rides vessel w/machine guns mounted				
																											Establish policy mandating night transits during the busiest fishing seasons.				

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Surface Attack	Small Boat Attack (Cole Type small boat Scenario)	Along track legs 6 & mid way through 7	Track line brings ship to within 650 yds (595m) off Clatsop Spit, 550yds (503m) off Hammond Marina Pt, and 400yds (366m) off Tansy Pt. Ft Stevens State Park population south of Jetty Lagoon increases to Medium in summer due to influx of campers/vacationers. (June to Sept) The summer influx of vacationers increases activity on he northern tip of Clatsop Spit but does not reach a Medium population density. The population of Warrenton also considered to increase to Medium density due to the influx of vacationers during that period.	Double hull					Establish 500 yd safety/security zone around inbound/loaded LNG tankers.																		Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.				
			Clatsop Spit (North of etty Lagoon) **one 2 3 Low population**	Existing boating awareness programs to look for and report unusual/suspicious activity in marinas, boat ramps and other waterfront areas – Americas Waterway Watch Program (Coast Watch)	1	4	1	4	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent)	1	3	1	3	2	3	1	6	Increase air and surface patrols of area to enhance MDA.	2	2	1	4	3	2	1	6	Conduct armed air escort during ship transit inbound coordinating with surface escort boats.	3	1	1	3
			Hammond Marina Pt **one 1 Low population** **one 2 3 Med pop (summer)**	CG conducts periodic air and surface harbor patrols and other missions in the area that contribute to maintaining Maritime Domain Awareness and providing a level of deterrence. (MDA)	1	4	2	8	Harbor patrols to be conducted periodically.	1	3	2	6	2	3	2	12	Enforce strict 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.	2	1	2	4	3	1	2	6	Close marinas down river of Astoria-Meglar Bridge to outgoing boat traffic one hour prior to ship arrival at Bar	3	1	2	6
									Establish policy mandating night transits during the busiest fishing seasons.									Establish policy mandating night transits during the busiest fishing seasons.									CG MSST/qualified LE Team rides vessel w/machine guns mounted. Establish policy mandating night transits during the busiest fishing seasons.				
			Tansy Pt **one 1 2 3 Low population** **one 1 2 3 - Medium population (summer)**	Routine enforcement patrols by OSPD and WDFW also contributes to MDA and deterrence	1	4	2	8		1	3	2	6	2	3	2	12		2	1	2	4	3	1	2	6		3	1	2	6
		Track leg 7 & 8 (upriver half of 7)	This part ot track begins halfway through leg 7 and continues into the dredged turning basin where ship is then maneuvered around and pushed to pier by tugs. The nearest point of land inthis part of track leg 7 & track leg 8 is 620 yds (567m) at the eastern Skipanon peninsula. This segment of track is where Zone 3 begins to overlap part of Astoria. The following Zone of Concern overlap includes (assumed ship a ship width off pier):	Double hull Existing homeland security/boating awareness programs to look for and report unusual/suspicious activity in marinas, boat ramps and other waterfront areas – Americas Waterway Watch Program (Coast Watch)					Establish 500 yd safety/security zone around inbound/loaded LNG tankers.									Increase air and surface patrols of area to enhance MDA.									Conduct armed air escort during ship transit inbound coordinating with surface escort boats.				
			one 2 Low population **one 3 Medium population (Astoria year round Warrenton in summer)**	CG conducts periodic air and surface harbor patrols and other missions in the area that contribute to maintaining Maritime Domain Awareness and providing a level of deterrence. (MDA)	1	4	1	4	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent).	1	3	1	3	2	3	1	6	Enforce strict 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.	2	2	1	4	3	2	1	6	Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.	3	1	1	3
									Harbor patrols to be conducted periodically.																		CG MSST/qualified LE Team rides vessel w/machine guns mounted.				
				Routine enforcement patrols by OSPD and WDFW also contributes to MDA and deterrence					Establish policy mandating night transits during the busiest fishing seasons.									Establish policy mandating night transits during the busiest fishing seasons.									Establish policy mandating night transits during the busiest fishing seasons.				

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Surface Attack	Small Boat Attack (Cole Type small boat Scenario)	Dockside	Breach in fixed position at dock. Proposed pier position is approximately 560 yds (512m) from tip of Skipanon peninsula, 1700 yds (1555m) from Tansy Pt, and 2800yds (2560m) from nearest point of land at Astoria.	Double hull					Establish 200yd fixed security zone around terminal pier.																		CG MSST/qualified LE Team remains on vessel w/machine guns mounted.				
			one 1 2 Low population **one 3 Medium population**	Existing homeland security/boating awareness programs to look for and report unusual/suspicious activity in marinas, boat ramps and other waterfront areas – Americas Waterway Watch Program (Coast Watch)	1	4	1	4	Enforce fixed security zone with either; Two armed small boats with deterrence capability, or install anti-boat barrier with one security boat.	1 1	3 1	1 1	3 1	2 2	3 1	1 1	6 2	Increase fixed security zone to 500yds.	2 2	2 1	1 1	4 2	3 3	2 1	1 1	6 3[2]	Enforce 1000 yd security with a min of 3 armed boats capable of response (or 1 boat/barrier).	3 3	1 1	1 1	3 3[2]
									Harbor patrols to be conducted periodically.									Increase air and surface patrols of area to enhance MDA.									Increase air and surface patrols of area to enhance MDA.				
				Routine enforcement patrols by OSPD and WDFW also contributes to MDA and deterrence					Install CCTV on mooring facility to provide continuous waterside monitoring with facility security personnel.									Enforce fixed security zone:2 armed small boats with deterrence/ response capability, or maintain 1 boat w/anti-boat barrier.									An electronic loudspeaker/hailing system such as LRAD should be implemented.				
				CG conducts periodic air and surface harbor patrols and other missions in the area that contribute to maintaining Maritime Domain Awareness and providing a level of deterrence. (MDA)					Install electronic loudspeaker system or directed sound system to enable security personnel to warn off boats coming within security zone when security boats not available.																						

[1] Score based on present day security operations, procedures, policies. Doesn't reflect new practices that would be necessary for LNG ships.

[2] Scores reflect risk values if anti-boat barrier installed contrasted to score above it reflecting security boats, but no barrier.

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Surface Attack	Large Ship Ramming loaded inbound LNG ship (Hi ack scenario on another ship)	Along entire track leg 1	Breach along this offshore leg of the track line towards the Columbia River mouth is well beyond any zone of concern touching land. Nearest point of land is 5.7nm **No one of concern overlap with land** **Not credible considering difficulty of execution and lack of visible consequence.**	Double hull Distance off shore in open ocean Detection of other ships with radar and AIS Ship comms to call other ship if acting dangerously Compulsory pilots on larger commercial ships entering/leaving Columbia River Shipboard Security Alert System (SSAS) installed on LNG ships Established procedure fo ANOA/ANE which permits CG to vet crew prior to entry into Columbia River. Crews on ships departing the river should have already been vetted.	1	2			None.	1	2			2	2				2	2			3	2				3	2		
		Along track leg 2 to position abeam of Lighted Buoy 4.	Breach along this offshore leg of the track line towards the Columbia River mouth is beyond any zone of concern touching land. Nearest point of land is 4400yds ((4023m) from outer tip of south jetty , 4850yds (4435m) from outer most tip off south jetty, and 5700yds (5212m) from actual nearest point of land which is western tip of Cape Disappointment State Park. **No one of concern overlap with land**	Double hull Distance offshore in open ocean Compulsory pilots on larger commercial ships entering/leaving Columbia River Shipboard security plan required to be in effect on all commercial ships. Ship Captain & pilot can track other ships in area with radar and AIS. Pilots routinely call ships on radio to make passing arrangements or to query if acting unusually dangerously. Established procedure fo ANOA/ANE which permits CG to vet crew prior to entry into Columbia River. Crews on ships departing the river should have already been vetted. Shipboard Security Alert System (SSAS) installed on LNG ships	1	3			None.	1	3			2	3				2	3			3	3				3	3		

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Surface Attack	Large Ship Ramming loaded inbound LNG ship (Hi ack scenario on another ship)	Along track leg 2, from buoy 4, track leg 3, track leg 4, and 5.	Sandia specified that a large ship striking an LNG tanker at t near right angle going over 7kts would penetrate the cargo tanks. It is not possible for large commercial ships to get a 90 degree angle in the 600' wide river channels. That said, a bow on collision at a high relative speed, such as 20kts relative would cause a good deal of structural damage, and may cause a crack the hulls. While unlikely will assume a cargo breach. Overtaking ships would not have enough relative speed to cause a breach. Ships following these track legs transit within 1200 yds (1097m) of the north jetty 1600yds (1463m) of the southernmost tip off Cape Disappointment and 700 yds (640m) of Jetty A the end of this track segment approaches to 1800 yds (1646m) of northern tip of Clatsop Spit and 1400 yds (1280m) off southern end of Sand Is. Breach of cargo tank while ship is on this part of the track line will result in following zone of concern overlaps:	Double hull Compulsory pilots on larger commercial ships entering/leaving Columbia River					Establish vessel management policy (one - way traffic) to avoid meeting situations by large commercial ships with inbound loaded LNG carriers.									Establish vessel management policy to hold outbound ships further back when waiting for inbound LNG ship to clear channel.									Establish vessel management policy to hold outbound ships further back when waiting for inbound LNG ship to clear channel.				
			one 2 3 Low population (north etty etty A southern tip of Sand Island and approx 2 yds of northern tip of Clatsop Spit).	Shipboard security plan required to be in effect.	1	3	1	3	Periodic "positive control boarding" of downbound vessels whenever an LNG vessel is inbound	1	2	1	2	2	2	1	4	Increased positive control boarding of downbound vessels.	2	1	1	2	3	1	1	3	Positive control boarding of downbound vessels.	3	1	1	3
			Seasonal Cape Disappointment State Park will surge to about 5000 people in a day during summer season. Ft Stevens State Park also increases in the number of people, but main concentration is south of Jetty Lagoon.	Established procedure for ANOA/ANE which permits CG to vet crew prior to entry into Columbia River. Crews on ships departing the river should have already been vetted.	1	3	2	6		1	2	1	2	2	2	1	4		2	1	1	2	3	1	1	3		3	1	1	3
			Seasonal The area along track legs 3, 4, & 5 could have very high density boating density during Buoy 10 fishing season in September. May have concentrations of 2K boats in a confined area. **one 1 Medium population (August)**	Shipboard Security Alert System (SSAS) installed on LNG ships	1	3	3		Estabish night time transit requirement during busiest fishing seasons (June - Sept)	1	2	1	2	2	2	1	4	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	2	1	1	2	3	1	1	3	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	3	1	1	3
		Along track legs 6 & mid way through 7	Track line brings ship to within 650 yds (595m) off Clatsop Spit, 550yds (503m) off Hammond Marina Pt, and 400yds (366m) off Tansy Pt. Ft Stevens State Park population south of Jetty Lagoon increases to Medium in summer due to influx of campers/vacationers. (June to Sept) The summer influx of vacationers increases activity on he northern tip of Clatsop Spit but does not reach a Medium population density. The population of Warrenton also considered to increase to Medium density due to the influx of vacationers during that period.	Double hull Compulsory pilots on larger commercial ships entering/leaving Columbia River Shipboard security plan required to be in effect.					Establish vessel management policy (one-way traffic) to avoid meeting situations by large commercial ships with inbound loaded LNG carriers.									Establish vessel management policy to hold outbound ships further back when waiting for inbound LNG ship to clear channel.									Establish vessel management policy to hold outbound ships further back when waiting for inbound LNG ship to clear channel.				
			Clatsop Spit (North of etty Lagoon) **one 2 3 Low population**	Established procedure for ANOA/ANE which permits CG to vet crew prior to entry into Columbia River.	1	3	1	3	Periodic "positive control boarding" of downbound vessels whenever an LNG vessel is inbound	1	2	1	2	2	2	1	4		2	1	1	2	3	1	1	3	Positive control boarding of lead downbound vessel.	3	1	1	3
			Hammond Marina Pt **one 1 Low population** **one 2 3 Med pop (summer)**	Crews on ships departing the river should have already been vetted.	1	3	2	6		1	2	2	4	2	2	2	8	Increased positive control boarding of downbound vessels.	2	1	2	4	3	1	2	6		3	1	2	6
			Tansy Pt **one 1 2 3 Low population** **one 1 2 3 - Medium population (summer)**	Shipboard Security Alert System (SSAS) installed on LNG ships	1	3	2	6	Estabish night time transit requirement during busiest fishing seasons (June - Sept)	1	2	2	4	2	2	2	8	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	2	1	2	4	3	1	2	6	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	3	1	2	6

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Surface Attack	Large Ship Ramming loaded inbound LNG ship (Hi ack scenario on another ship)	Track leg 7 & 8 (upriver half of 7)	Potential exists for a ship to ram the incoming LNG ship while being twisted around for mooring. The beam of the ship would be briefly exposed to upbound and downbound ships. Tugs alongside the maneuvering LNG carrier might partially block an attempt to ram, but not fully.	Double hull					Establish vessel management policy to prohibit other ships approaching/passing maneuvering loaded LNG ships until completely twisted around and being pushed toward the dock.									Establish vessel management policy to hold outbound ships further back when waiting for inbound LNG ship to clear channel.									Establish vessel management policy to prohibit other ships approaching/passing maneuvering loaded LNG ships until completely twisted around and being pushed toward the dock.				
			Breach while ship is turning or being maneuvered to pier with nearest point of land 620 yds (567m) at the eastern Skipanon peninsula could result in following Zone of Concern overlap (assumed ship a ship width off pier):	Compulsory pilots on larger commercial ships entering/leaving Columbia River					Periodic "positive control boarding" of downbound vessels whenever an LNG vessel is inbound.																						
			one 2 Low population **one 3 Medium population (Astoria year round Warrenton in summer)**	Shipboard security plan required to be in effect.	1	4	1	4		1	2	1	2	2	2	1	4	Increased positive control boarding of downbound vessels.	2	1	1	2	3	1	1	3	Positive control boarding of lead downbound vessel	3	1	1	3
				Established procedure for ANOA/ANE which permits CG to vet crew prior to entry into Columbia River. Crews on ships departing the river should have already been vetted.																											
				Shipboard Security Alert System (SSAS) installed on LNG ships					Estabish night time transit requirement during busiest fishing seasons (June - Sept)									Estabish night time transit requirement during busiest fishing seasons (June - Sept)									Estabish night time transit requirement during busiest fishing seasons (June - Sept)				
		Dockside	Breach in fixed position at dock. Proposed pier position is approximately 560 yds (512m) from tip of Skipanon peninsula, 1700 yds (1555m) from Tansy Pt, and 2800yds (2560m) from nearest point of land at Astoria.	Double Hull Compulsory pilots on larger commercial ships entering/leaving Columbia River					Periodic "positive control boarding" of transitting vessels of over 50,000 GTwhenever an LNG vessel is moored.									Increased "positive control boarding" of transitting vessels of over 50,000 GT whenever an LNG vessel is moored.									"Positive control boarding" of all vessels of over 50,000 GT transiting past a moored LNG vessel.				
			one 1 2 Low population **one 3 Medium population**	Shipboard security plan required to be in effect.	1	4	1	4	Policy or guidance should be developed requiring at least one of the Skipanon Facility tugs to escort all upbound and downbound vessels of over 50,000 GT between Buoys 27 & 31. A second tug shall be in immediate standby in the terminal basin	1	3	1	3	2	3	1	6	Policy or guidance should be developed requiring at least one of the Skipanon Facility tugs to escort all upbound and downbound vessels of over 50,000 GT between Buoys 27 & 31. A second tug shall be in immediate standby in the terminal basin	2	2	1	4	3	2	1	6	Policy or guidance should be developed requiring at least one of the Skipanon Facility tugs to escort all upbound and downbound vessels of over 50,000 GT between Buoys 27 & 31. A second tug shall be in immediate standby in the terminal basin	3	1	1	3
				Established procedure for ANOA/ANE which permits CG to vet crew prior to entry into Columbia River. Crews on ships departing the river should have already been vetted. Shipboard Security Alert System (SSAS) installed on LNG ships																											

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Pro ectile Attack	Stand Off Weapon Launched from Boat Assume ship remains on track and under power	Along entire track leg 1 and along track leg 2 to position abeam of Bouy 4	Breach along this offshore leg of the track line towards the Columbia River mouth is beyond any zone of concern touching land. Nearest point of land is 4400yds ((4023m) from outer tip of south jetty , 4850yds (4435m) from outer most tip off south jetty, and 5700yds (5212m) from actual nearest point of land which is western tip of Cape Disappointment State Park. **No one of concern overlap with land**	Double hull Ocean sea state will often make boat launch platform unstable CG conducts periodic air and surface harbor patrols and other missions in the area that contribute to maintaining Maritime Domain Awareness and providing a level of deterrence. (MDA) Routine enforcement patrols by OSPD and WDFW also contributes to MDA and deterrence Existing homeland security/boating awareness programs to look for and report unusual/suspicious activity in marinas, boat ramps and other waterfront areas – Americas Waterway Watch Program (Coast Watch) Distance offshore Open Ocean steaming at sea speed Pilot aboard able to communicate/alert enforcement agencies if there is unusual boating activity.	1	4			Conduct CG security boardings prior to ship entry into River-presence of CG helo and/or boat will provide deterrence.	1	4			2	4			Increase frequency of security boardings. Increase air patrols of area to enhance MDA.	2	4			3	4			Air patrol in advance of ship heading towards river mouth. Small boat escort to begin at CR Bouy, weather permitting.	3	4		
		Along track leg 2, from buoy 4, track leg 3, track leg 4, and 5.	Ships following these track legs transit within 1200 yds (1097m) of the north jetty 1600yds (1463m) of the southernmost tip off Cape Disappointment and 700 yds (640m) of Jetty A the end of this track segment approaches to 1800 yds (1646m) of northern tip of Clatsop Spit and 1400 yds (1280m) off southern end of Sand Is. Breach of cargo tank while ship is on this part of the track line will result in following zone of concern overlaps:	Double hull Ship movement makes targeting more difficult Sea state in Columbia River Bar will often interfere with small boat ops and make firing from boat difficult					Establish safety/security zone around inbound/loaded LNG tankers extending from the CR Buoy to the dock.									Increase air and surface patrols of area to enhance MDA.									Conduct air and surface patrol of transit route in advance of arriving ship.				
			one 2 3 Low population (north etty etty A southern tip of Sand Island and approx 2 yds of northern tip of Clatsop Spit).	Existing homeland security/boating awareness programs to look for and report unusual/suspicious activity in marinas, boat ramps and other waterfront areas – Americas Waterway Watch Program (Coast Watch)	1	4	1	4	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent).	1	3	1	3	2	3	1	6	Enforce strict 500 yard security zone with minimum of 3 armed security boats. One of the three boats armed at response level.	2	2	1	4	3	2	1	6	Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.	3	1	1	3
			Seasonal Cape Disappointment State Park will surge to about 5000 people in a day during summer season. Ft Stevens State Park also increases in the number of people, but main concentration is south of Jetty Lagoon. **one 3 - Medium population (une through early Sept)**	CG conducts periodic air and surface harbor patrols and other missions in the area that contribute to maintaining Maritime Domain Awareness and providing a level of deterrence. (MDA)	1	4	1	4	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	1	3	1	3	2	3	1	6	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	2	2	1	4	3	2	1	6	Conduct air escort during ship transit inbound coordinating with surface escort boats.	3	1	1	3
			Seasonal The area along track legs 3, 4, & 5 could have very high density boating density during Buoy 10 fishing season in September. May have concentrations of 2K boats in a confined area. **one 1 Medium population (August)**	Routine enforcement patrols by OSPD and WDFW also contributes to MDA and deterrence	1	4	3	12		1	3	1	3	2	3	1	6		2	2	1	4	3	2	1	6	Close marinas down river of Astoria-Meglar Bridge to outgoing boat traffic one hour prior to ship arrival at Bar.	3	1	1	3
																											Estabish night time transit requirement during busiest fishing seasons (June - Sept).				

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Pro ectile Attack	**Stand Off Weapon Launched from Boat Assume ship remains on track and under power**	Along track legs 6 & mid way through 7	Track line brings ship to within 650 yds (595m) off Clatsop Spit, 550yds (503m) off Hammond Marina Pt, and 400yds (366m) off Tansy Pt. Ft Stevens State Park population south of Jetty Lagoon increases to Medium in summer due to influx of campers/vacationers. (June to Sept) The summer influx of vacationers increases activity on he northern tip of Clatsop Spit but does not reach a Medium population density. The population of Warrenton also considered to increase to Medium density due to the influx of vacationers during that period.	Double hull Existing homeland security/boating awareness programs to look for and report unusual/suspicious activity in marinas, boat ramps and other waterfront areas – Americas Waterway Watch Program (Coast Watch)					Establish safety/security zone around inbound/loaded LNG tankers.																						
			Clatsop Spit (North of etty Lagoon) **one 2 3 Low population**	CG conducts periodic air and surface harbor patrols and other missions in the area that contribute to maintaining Maritime Domain Awareness and providing a level of deterrence. (MDA)	1	4	1	4	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent).	1	3	1	3	2	3	1	6	Increase air and surface patrols of area to enhance MDA.	2	2	1	8	3	2	1	6	Conduct air and surface patrol of transit route in advance of arriving ship.	3	1	1	3
			Hammond Marina Pt **one 1 Low population** **one 2 3 Med pop (summer)**	Routine enforcement patrols by OSPD and WDFW also contributes to MDA and deterrence	1	4	2	8		1	3	2	6	2	3	2	12	Strict enforcement of 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.	2	1	2	4	3	1	2	6	Conduct air escort during ship transit inbound coordinating with surface escort boats.	3	1	2	6
			Tansy Pt **one 1 2 3 Low population** **one 1 2 3 - Medium population (summer)**		1	4	2	8		1	3	2	6	2	3	2	12	Estabish night time transit requirement during busiest fishing seasons (June - Sept)	2	1	2	4	3	1	2	6	Close marinas down river of Astoria-Meglar Bridge to outgoing boat traffic one hour prior to ship arrival at Bar. Estabish night time transit requirement during busiest fishing seasons (June - Sept). Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.	3	1	2	6
		Track leg 7 & 8 (upriver half of 7)	Breach while ship is turning or being maneuvered to pier with nearest point of land 620 yds (567m) at the eastern Skipanon peninsula could result in following Zone of Concern overlap (assumed ship a ship width off pier):	Double hull					Establish safety/security zone around inbound/loaded LNG tankers.																		Conduct air and surface patrol of transit route in advance of arriving ship.				
			one 2 Low population **one 3 Medium population (Astoria year round Warrenton in summer)**	Existing homeland security/boating awareness programs to look for and report unusual/suspicious activity in marinas, boat ramps and other waterfront areas – Americas Waterway Watch Program (Coast Watch)	1	4	1	4	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent).	1	3	1	3	2	3	1	6	Increase air and surface patrols of area to enhance MDA.	2	2	1	4	3	2	1	6	Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.	3	1	1	3
				CG conducts periodic air and surface harbor patrols and other missions in the area that contribute to maintaining Maritime Domain Awareness and providing a level of deterrence. (MDA) Routine enforcement patrols by OSPD and WDFW also contributes to MDA and deterrence					Estabish night time transit requirement during busiest fishing seasons (June - Sept).									Strict enforcement of 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.									Conduct air escort during ship transit inbound coordinating with surface escort boats. Close marinas down river of Astoria-Meglar Bridge to outgoing boat traffic one hour prior to ship arrival at Bar. Estabish night time transit requirement during busiest fishing seasons (June - Sept)				

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)

Category	What If	Location	Consequence	Existing Safeguards	Initial Score[1] Threat	Initial Vulnerability	Initial Consequences	Initial Risk	MARSEC - 1 Proposed Risk Management Strategies	M1 Ad usted Threat	M1 Ad usted Vulnerability	M1 Ad usted Consequences	M1 Ad usted Risk	M2 Initial Threat	M2 Initial Vulnerability	M2 Initial Consequences	M2 Initial Risk	MARSEC - 2 Proposed Risk Management Strategies	M2 Ad usted Threat	M2 Ad usted Vulnerability	M2 Ad usted Consequences	M2 Ad usted Risk	M3 Initial Threat	M3 Initial Vulnerability	M3 Initial Consequences	M3 Initial Risk	MARSEC - 3 Proposed Risk Management Strategies	M3 Ad usted Threat	M3 Ad usted Vulnerability	M3 Ad usted Consequences	M3 Ad usted Risk
Pro ectile Attack	Stand Off Weapon Launched from Boat Assume ship remains on track and under power	Dockside	Breach in fixed position at dock. Proposed pier position is approximately 560 yds (512m) from tip of Skipanon peninsula, 1700 yds (1555m) from Tansy Pt, and 2800yds (2560m) from nearest point of land at Astoria. With boat barrier **one 1 2 Low population** **one 3 Medium population**	Double hull Existing homeland security/boating awareness programs to look for and report unusual/suspicious activity in marinas, boat ramps and other waterfront areas – Americas Waterway Watch Program (Coast Watch) CG conducts periodic air and surface harbor patrols and other missions in the area that contribute to maintaining Maritime Domain Awareness and providing a level of deterrence. (MDA) Routine enforcement patrols by OSPD and WDFW also contributes to MDA and deterrence	1	4	1	4	Establish 200 yard fixed security zone around terminal pier. Enforce fixed security zone with either; Two armed small boats with response capability, or install anti-boat barrier with one security boat to provide response capability. Install CCTV at facility to provide continuous waterside monitoring with facility security personnel. Install electronic loudspeaker system or directed sound system to enable security personnel to warn off boats coming within security zone when security boats not available.	1	3	1	3	2	3	1	6	Increase fixed security zone to 500yds. Enforce fixed security zone:2 armed small boats with deterrence/ response capability, or maintain 1 boat w/anti-boat barrier. Installed CCTV to be monitored continuously by facility security personnel.	2	2	1	4	3	2	1	6	Enforce 500 yd security with a min of 3 armed boats capable of response (or 1 boat/barrier) Installed CCTV to be monitored continuously by facility security personnel.	3	1	1	3

1 Score based on present day security operations, procedures, policies. Doesn't reflect new practices that would be necessary for LNG ships.

Category	What If	Location	Consequence	Existing Safeguards	Initial Threat	Initial Vulnerability	Initial Consequences	Initial Risk	MARSEC - 1 Proposed Risk Management Strategies	M1 Ad usted Threat	M1 Ad usted Vulnerability	M1 Ad usted Consequences	M1 Ad usted Risk	M2 Initial Threat	M2 Initial Vulnerability	M2 Initial Consequences	M2 Initial Risk	MARSEC - 2 Proposed Risk Management Strategies	M2 Ad usted Threat	M2 Ad usted Vulnerability	M2 Ad usted Consequences	M2 Ad usted Risk	M3 Initial Threat	M3 Initial Vulnerability	M3 Initial Consequences	M3 Initial Risk	MARSEC - 3 Proposed Risk Management Strategies	M3 Ad usted Threat	M3 Ad usted Vulnerability	M3 Ad usted Consequences	M3 Ad usted Risk
Pro ectile Attack	Stand Off Weapon Launched from Shore Structure (Assume m max effective range)	Hammond Marina Point (point of land north of marina)	Track line passes approximately 550 yds (503m) off of the point of land. **one 1 Low population** **one 2 3 Med pop (summer)**	Double Hull Moving ship	1	2	2	4	Shoreside patrol by law enforcment personnel in advance of arriving LNG ship to watch for suspicious activity. Security zone escort boat to observe shoreside areas prior to beginning escort and during escort.	1	1	2	2	2	1	2	4	Shoreside law enforcement presence increased along shoreline areas.	2	1	2	4	3	1	2	6	Continuous shore presence at each location by enforcement personnel as ship passes. At MARSEC Level 3 the security zone escort boat should be supported with an air escort.	3	1	2	6
		Tansy Pt / Nygard Dock area	Track line passes approximately 400 yds (366m) off of the dock face. **one 1 Low population** **one 2 3 - Medium population (summer)**	Double Hull Moving ship	1	4	2	8	Shoreside patrol by law enforcment personnel in advance of arriving LNG ship to watch for suspicious activity. Security zone escort boat to observe shoreside areas prior to beginning escort and during escort. Warrenton Fiber facility on Tansy Pt. While no specific MTSA security plan, facility is active during work days and would notice unusual/suspicious activity.	1	1	2	2	2	1	2	4	Shoreside law enforcement presence increased along shoreline areas. Notify Warrenton Fiber to be alert for suspicious activity.	2	1	2	4	3	1	2	6	Continuous shore presence at each location by enforcement personnel as ship passes. At MARSEC Level 3 the security zone escort boat should be supported with an air escort.	3	1	2	6

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Aerial Attack	Small aircraft	Along entire track leg 1 and track leg 2 to position abeam of Lighted Buoy 4.	Breach along this offshore leg of the track line towards the Columbia River mouth is beyond any zone of concern touching land. Nearest point of land is 4400yds ((4023m) from outer tip of south jetty , 4850yds (4435m) from outer most tip off south jetty, and 5700yds (5212m) from actual nearest point of land which is western tip of Cape Disappointment State Park.	Double hull Distance offshore Open ocean steaming at sea speed	1	4			None	1	4			2	4			Advise local airport(s) of increased threat to be on alert for new people, planes or suspicious loading activity.	2	4			3	4			Advise local airport(s) of increased threat to be on alert for new people, planes or suspicious loading activity.	3	4		
		Along track leg 2, from buoy 4, track leg 3, track leg 4, and 5.	Ships following these track legs transit within 1200 yds (1097m) of the north jetty 1600yds (1463m) of the southernmost tip off Cape Disappointment and 700 yds (640m) of Jetty A the end of this track segment approaches to 1800 yds (1646m) of northern tip of Clatsop Spit and 1400 yds (1280m) off southern end of Sand Is. Breach of cargo tank while ship is on this part of the track line will result in following zone of concern overlaps:	Double hull Ship movement increases difficulty of targeting					Establish safety/security zone around inbound/loaded LNG tankers.									Advise local airport(s) of increased threat to be on alert for new people, planes or suspicious loading activity.									Advise local airport(s) of increased threat to be on alert for new people, planes or suspicious loading activity.				
			one 2 3 Low population (north etty etty A southern tip of Sand Island and approx 2 yds of northern tip of Clatsop Spit).		1	4	1	4	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent)	1	4	1	4	2	4	1	8	Strict enforcement of 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.(machine guns)	2	4	1	8	3	4	1	12	Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.(machine guns)	3	3	1	
			Seasonal Cape Disappointment State Park will surge to about 5000 people in a day during summer season. Ft Stevens State Park also increases in the number of people, but main concentration is south of Jetty Lagoon. **one 3 - Medium population (une through early Sept)**		1	4	1	4	Two tug escort .	1	4	1	4	2	4	1	8	Two tug escort .	2	4	1	8	3	4	1	12	Two tug escort .	3	3	1	
			Seasonal The area along track legs 3, 4, & 5 could have very high density boating density during Buoy 10 fishing season in September. May have concentrations of 2K boats in a confined area. **one 1 Medium population (August)**		1	4	3	12	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	1	4	1	4	2	4	1	8	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	2	4	1	8	3	4	1	12	Estabish night time transit requirement during busiest fishing seasons (June - Sept) Place MSST (CG) personnel on ship with crew served weapon for defense.	3	3	1	

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Aerial Attack	Small aircraft	Along track legs 6 & mid way through 7	Track line brings ship to within 650 yds (595m) off Clatsop Spit, 550yds (503m) off Hammond Marina Pt, and 400yds (366m) off Tansy Pt. Ft Stevens State Park population south of Jetty Lagoon increases to Medium in summer due to influx of campers/vacationers. (June to Sept) The summer influx of vacationers increases activity on he northern tip of Clatsop Spit but does not reach a Medium population density. The population of Warrenton also considered to increase to Medium density due to the influx of vacationers during that period.	Double hull Ship movement increases difficulty of targeting					Establish safety/security zone around inbound/loaded LNG tankers.									Advise local airport(s) of increased threat to be on alert for new people, planes or suspicious loading activity.									Advise local airport(s) of increased threat to be on alert for new people, planes or suspicious loading activity.				
			Clatsop Spit (North of etty Lagoon) **one 2 3 Low population**		1	4	1	4	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent).	1	4	1	4	2	4	1	8	Strict enforcement of 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.(machine guns)	2	4	1	8	3	4	1	12	Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.(machine guns).	3	3	1	
			Hammond Marina Pt **one 1 Low population** **one 2 3 Med pop (summer)**		1	4	2	8	Two tug escort joined by third or fourth tug between buoys 25 & 27.	1	4	2	8	2	4	2	16	Two tug escort .	2	4	2	16	3	4	2	24	Two tug escort .	3	3	2	18
			Tansy Pt **one 1 2 3 Low population** **one 1 2 3 - Medium population (summer)**		1	4	2	8	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	1	4	2	8	2	4	2	16	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	2	4	2	16	3	4	2	24	POSCON Team rides vessel w/machine guns mounted.	3	3	2	18
																											Estabish night time transit requirement during busiest fishing seasons (June - Sept)				
		Track leg 7 & 8 (upriver half of 7)	Breach while ship is turning or being maneuvered to pier with nearest point of land 620 yds (567m) at the eastern Skipanon peninsula could result in following Zone of Concern overlap (assumed ship a ship width off pier):	Double Hull					Establish safety/security zone around inbound/loaded LNG tankers.																		Advise local airport(s) of increased threat to be on alert for new people, planes or suspicious loading activity.				
			one 2 Low population **one 3 Medium population (Astoria year round Warrenton in summer)**		1	4	1	4	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent)	1	4	1	4	2	4	1	8	Strict enforcement of 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.(machine guns)	2	4	1	8	3	4	1	12	Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.(machine guns).	3	3	1	
									Three tugs alongside ship maneuvering for mooring									Three tugs alongside ship maneuvering for mooring									Three tugs alongside ship maneuvering for mooring.				
									Estabish night time transit requirement during busiest fishing seasons (June - Sept)									Estabish night time transit requirement during busiest fishing seasons (June - Sept).									POSCON Team rides vessel w/machine guns mounted.				
																											Estabish night time transit requirement during busiest fishing seasons (June - Sept).				

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Aerial Attack	Small aircraft	Dockside	Breach in fixed position at dock. Proposed pier position is approximately 560 yds (512m) from tip of Skipanon peninsula, 1700 yds (1555m) from Tansy Pt, and 2800yds (2560m) from nearest point of land at Astoria.	Double Hull														Airport awareness program to alert authorities of suspicious activity at local airports.									Airport awareness program to alert authorities of suspicious activity at local airports.				
			Without anti-boat barrier. **one 1 2 Low population** **one 3 Medium population**		1	4	1	4	Establish 200 yd fixed security zone around terminal pier	1	4	1	4	2	4	1	8	Increase fixed security zone to 500yds.	2	4	1	8	3	4	1	12	Increase fixed security zone to 1000yds.	3	3	1	
				Dock provides protection to southern side of ship					Maintain armed small boat presence to enforce security zone while ship is moored									Security boats (2) to be armed with crew served weapons (machine guns)									Security boats (3) to be armed with crew served weapons (machine				
																		Moor standby tugs on outboard of ship to create partial barrier									Moor standby tugs on outboard of ship to create partial barrier.				
			With anti-boat barrier. **one 1 2 Low population** **one 3 Medium population**		1	4	1	4		1	3	1	3	2	3	1	6		2	3	1	6	3	3	1		POSCON Team with crew served weapon for point defense.	3	3	1	
																											Direct communications to be established between USCG and air traffic control of transit area (ATC Seattle) prior to ship entering the Columbia River.				

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)				Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
What If		Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Aerial Attack	Commercial Aircraft	Along entire track leg 1 and track leg 2 to position abeam of Lighted Buoy 4.	Breach along this offshore leg of the track line towards the Columbia River mouth is beyond any zone of concern touching land. Nearest point of land is 4400yds ((4023m) from outer tip of south jetty , 4850yds (4435m) from outer most tip off south jetty, and 5700yds (5212m) from actual nearest point of land which is western tip of Cape Disappointment State Park.	Security board commercial aircraft involve: - passenger identification screening - TSA psychological observation screening - check -in & hand carry baggage inspections / xrays - carry-on items restrictions - sky marshall program - locked flight cabin	1	1			Ensure ATC for Portland area aware to notify CG if commercial aircraft deviates from normal routine when in area of LNG trackline.	1	1			2	1			None	2	1			3	1				3	1		
Aerial Attack	Commercial Aircraft	Along track leg 2, from buoy 4, track leg 3, track leg 4, and 5.	Ships following these track legs transit within 1200 yds (1097m) of the north jetty 1600yds (1463m) of the southernmost tip off Cape Disappointment and 700 yds (640m) of Jetty A the end of this track segment approaches to 1800 yds (1646m) of northern tip of Clatsop Spit and 1400 yds (1280m) off southern end of Sand Is. Breach of cargo tank while ship is on this part of the track line will result in following zone of concern overlaps:	Security board commercial aircraft involve: - passenger identification screening - TSA psychological observation screening - check -in & hand carry baggage inspections / xrays - carry-on items restrictions - sky marshall program - locked flight cabin																												
			one 2 3 Low population (north etty etty A southern tip of Sand Island and approx 2 yds of northern tip of Clatsop Spit).		1	1	1	1		1	1	1	1	2	1	1	2	Flight plan/management at local airports.	2	1	1	2	3	1	1	3	Flight plan/management at local airports.	3	1	1	3
			Seasonal: Cape Disappointment State Park will surge to about 5000 people in a day during summer season. (Ft Stevens will experience similar surge in visitors, but main concenration of people south of Jetty Lagoon.) **one 3 - Medium population (une through early Sept)**		1	1	1	1		1	1	1	1	2	1	1	2	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	2	1	1	2	3	1	1	3	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	3	1	1	3
			Seasonal The area along track legs 3, 4, & 5 could have very high density boating density during Buoy 10 fishing season in September. May have concentrations of 2K boats in a confined area. **one 1 Medium population (August)**		1	1	3	3		1	1	3	3	2	1	3	6		2	1	1	2	3	1	1	3		3	1	1	3
Aerial Attack	Commercial Aircraft	Track leg 6 & mid way through 7	Track line brings ship to within 650 yds (595m) off Clatsop Spit, 550yds (503m) off Hammond Marina Pt, and 400yds (366m) off Tansy Pt. Ft Stevens State Park population south of Jetty Lagoon increases to Medium in summer due to influx of campers/vacationers. (June to Sept) The summer influx of vacationers increases activity on he northern tip of Clatsop Spit but does not reach a Medium population density. The population of Warrenton also considered to increase to Medium density due to the influx of vacationers during that period.	Security board commercial aircraft involve: - passenger identification screening - TSA psychological observation screening - check -in & hand carry baggage inspections / xrays - carry-on items restrictions - sky marshall program - locked flight cabin														Flight plan/management at local airports									Flight plan/management at local airports.				
			Clatsop Spit (North of etty Lagoon) **one 2 3 Low population**		1	1	1	1		1	1	1	1	2	1	1	2	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	2	1	1	2	3	1	1	3	Estabish night time transit requirement during busiest fishing seasons (June - Sept)	3	1	1	3
			Hammond Marina Pt **one 1 Low population** **one 2 3 Med pop (summer)**		1	1	2	2		1	1	2	2	2	1	2	4		2	1	2	4	3	1	2	6		3	1	2	6
			Tansy Pt **one 1 2 3 Low population** **one 2 3 - Medium population (summer)**		1	1	2	2		1	1	2	2	2	1	2	4		2	1	2	4	3	1	2	6		3	1	2	6

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Aerial Attack	Commercial Aircraft	Track leg 7 & 8 (upriver half of 7)	Breach while ship is turning or being maneuvered to pier with nearest point of land 620 yds (567m) at the eastern Skipanon peninsula could result in following Zone of Concern overlap (assumed ship a ship width off pier): **one 2 Low population** **one 3 Medium population (Astoria year round Warrenton in summer)**	Security board commercial aircraft involve: - passenger identification screening - TSA psychological observation screening - check -in & hand carry baggage inspections / xrays - carry-on items restrictions - sky marshall program - locked flight cabin	1	1	1	1		1	1	1	1	2	1	1	2		2	1	1	2	3	1	1	3		3	1	1	3
Aerial Attack	Commercial Aircraft	Dockside	Breach in fixed position at dock. Proposed pier position is approximately 560 yds (512m) from tip of Skipanon peninsula, 1700 yds (1555m) from Tansy Pt, and 2800yds (2560m) from nearest point of land at Astoria. **one 1 2 Low population** **one 3 Medium population**	Security board commercial aircraft involve: - passenger identification screening - TSA psychological observation screening - check -in & hand carry baggage inspections / xrays - carry-on items restrictions - sky marshall program - locked flight cabin	1	1	1	1	None.	1	1	1	1	2	1	1	2	None.	2	1	1	2	3	1	1	3	None.	3	1	1	3
Underwater	(Mining)	Along entire track leg 1	Breach along this offshore leg of the track line towards the Columbia River mouth is beyond any zone of concern touching land. Nearest point of land is 4400yds ((4023m) from outer tip of south jetty , 4850yds (4435m) from outer most tip off south jetty, and 5700yds (5212m) from actual nearest point of land which is western tip of Cape Disappointment State Park.	Double hull Distance offshore Open ocean steaming at sea speed Periodic air surveillance of area	1	1			None	1	1			2	1				2	1			3	1				3	1		
Underwater	(Mining)	Along entire track leg 1	**Not credible attack vector in open ocean.** **No one of concern overlap with land**	Periodic surface enforcement patrols in area (CG, WDFW, OSPD) Pilot aboard able to communicate/alert enforcement agencies if there is unusual boating activity.		N	C				N	C			N	C				N	C			N	C				N	C	
Underwater	(Mining)	Along track leg 2, from buoy 4, track leg 3, track leg 4, and 5.	Ships following these track legs transit within 1200 yds (1097m) of the north jetty 1600yds (1463m) of the southernmost tip off Cape Disappointment and 700 yds (640m) of Jetty A the end of this track segment approaches to 1800 yds (1646m) of northern tip of Clatsop Spit and 1400 yds (1280m) off southern end of Sand Is. Breach of cargo tank while ship is on this part of the track line will result in following zone of concern overlaps:	Double hull Frequent ship/vessel traffic Very strong currents and periodic heavy weather					Establish safety/security zone around inbound/loaded LNG tankers.																		Conduct air and surface patrol of transit route in advance of arriving ship.				
Underwater	(Mining)	Along track leg 2, from buoy 4, track leg 3, track leg 4, and 5.	**one 2 3 Low population (north etty etty A southern tip of Sand Island and approx 2 yds of northern tip of Clatsop Spit).**	Periodic surface enforcement patrols in area (CG, WDFW, OSPD)	1	3	1	3	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent)	1	2	1	2	2	2	1	4	Increase air and surface patrols of area to enhance MDA.	2	1	1	2	3	1	1	3	Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.	3	1	1	3
Underwater	(Mining)	Along track leg 2, from buoy 4, track leg 3, track leg 4, and 5.	**Seasonal** Cape Disappointment State Park will surge to about 5000 people in a day during summer season. (Ft Stevens will experience similar surge in visitors, but main concenration of people south of Jetty Lagoon.) **one 3 - Medium population (une through early Sept)**		1	3	1	3	Two tug escort commence along this segment of track to provide immediate assistance if needed and provide additional presence for security escort. At least one tug should be tethered.	1	2	1	2	2	2	1	4	Strictly enforced 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.	2	1	1	2	3	1	1	3	The marinas down river of the Astoria-Megler Bridge should be closed top out bound small boat traffci one hour prior to an LNG vessel arrival at the Bar.	3	1	1	3
Underwater	(Mining)	Along track leg 2, from buoy 4, track leg 3, track leg 4, and 5.	**Seasonal** The area along track legs 3, 4, & 5 could have very high density boating density during Buoy 10 fishing season in September. May have concentrations of 2K boats in a confined area. **one 1 Medium population (August)**		1	3	3		Estabish night time transit requirement during busiest fishing seasons (June - Sept)	1	2	1	2	2	2	1	4	Estabish night time transit requirement during busiest fishing seasons (June - Sept).	2	1	1	2	3	1	1	3	Conduct air escort during ship transit inbound coordinating with surface escort boats. Estabish night time transit requirement during busiest fishing seasons (June - Sept).	3	1	1	3

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Underwater	(Mining)	Along track legs 6 & mid way through 7	Track line brings ship to within 650 yds (595m) off Clatsop Spit, 550yds (503m) off Hammond Marina Pt, and 400yds (366m) off Tansy Pt. Ft Stevens State Park population south of Jetty Lagoon increases to Medium in summer due to influx of campers/vacationers. (June to Sept) The summer influx of vacationers increases activity on he northern tip of Clatsop Spit but does not reach a Medium population density. The population of Warrenton also considered to increase to Medium density due to the influx of vacationers during that period.	Double Hull Frequent ship/vessel traffic Strong tidal/river currents					Establish safety/security zone around inbound/loaded LNG tankers.																		Conduct air and surface patrol of transit route in advance of arriving ship.				
			Clatsop Spit (North of etty Lagoon) **one 2 3 Low population**	Periodic surface enforcement patrols in area (CG, WDFW, OSPD)	1	3	1	3	Enforce security zone with minimum of two armed escort boats, allowing vessels to approach to within 100 yds providing they are moving at bare steerageway. Boats to be armed at level for deterrence (marked LE vessel, side arms sufficent)	1	2	1	2	2	2	1	4	Increase air and surface patrols of area to enhance MDA.	2	1	1	2	3	1	1	3	Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.	3	1	1	3
			Hammond Marina Pt **one 1 Low population** **one 2 3 Med pop (summer)**		1	3	2	6	Two tug escort joined by third tug vicinity of Tansy Pt turn (track leg 7).	1	2	2	4	2	2	2	8	Strictly enforced 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.	2	1	2	4	3	1	2	6	Conduct air escort during ship transit inbound coordinating with surface escort boats.	3	1	2	6
			Tansy Pt **one 1 2 3 Low population** **one 1 2 3 - Medium population (summer)**		1	3	2	6		1	2	2	4	2	2	2	8	Estabish night time transit requirement during busiest fishing seasons (June - Sept)	2	1	2	4	3	1	2	6	The marinas down river of the Astoria-Megler Bridge should be closed top out bound small boat traffci one hour prior to an LNG vessel arrival at the Bar.	3	1	2	6
		Track leg 7 & 8 (upriver half of 7)	Breach while ship is turning or being maneuvered to pier with nearest point of land 620 yds (567m) at the eastern Skipanon peninsula could result in following Zone of Concern overlap (assumed ship a ship width off pier):	Double Hull Terminal will maintain surveillance of waterside area if established Strong tidal/river currents					Establish safety/security zone around inbound/loaded LNG tankers.									Increase air and surface patrols of area to enhance MDA.									Conduct air and surface patrol of transit route in advance of arriving ship.				
			one 2 Low population **one 3 Medium population (Astoria year round Warrenton in summer)**	Periodic surface enforcement patrols in area (CG, WDFW, OSPD)	1	2	1	2	Enforce security zone with armed escort boats these boats will be able to monitor vessel activity in turning basin area as well if suspicious activity occurs.	1	1	1	1	2	1	1	2	Strictly enforced 500 yd security zone with minimum of 3 armed security boats. One of the three boats armed at response level.	2	1	1	2	3	1	1	3	Enforce sec zone with minimum of 4 armed escort boats to within 1000yds. 3 of the four boats armed for response.	3	1	1	3
				Three tugs will be routinely operating in area that would also observe the area for suspicious objects in water or activity.																							Conduct air escort during ship transit inbound coordinating with surface escort boats. The marinas down river of the Astoria-Megler Bridge should be closed top out bound small boat traffic one hour prior to an LNG vessel arrival at the Bar.				

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Underwater	Divers	Entire track line	Not credible/feasible when ship underway	Double hull Vessel movement over water River current		N	C		Establish security zone around loaded LNG tanker Enforce zone with armed security boats		N	C			N	C				N	C			N	C				N	C	
		Dockside	Breach in fixed position at dock. Proposed pier position is approximately 560 yds (512m) from tip of Skipanon peninsula, 1700 yds (1555m) from Tansy Pt, and 2800yds (2560m) from nearest point of land at Astoria.	Double hull River current Low visibility in water					Establish 200yd fixed security zone around terminal dock.									Increase fixed security zone to 500yds.									Enforce 1,000 yd security with a min of 3 armed boats capable of response (or 1 boat/barrier).				
			one 1 2 Low population **one 3 Medium population**	Tug activiy in vicinity of pier	1	3	1	3	Maintain small boat presence to enforce safety/ security zone when ships are moored.	1	2	1	2	2	2	1	4		2	1	1	2	3	1	1	3	Underwater pier inspections prior to ship arrival.	3	1	1	3
									24 hr video surveillance coverage of dock area.									Enforce fixed security zone:2 armed small boats with deterrence/ response capability, or maintain 1 boat w/anti-boat barrier.													
									Routine security rounds by terminal personnel to include to observation of water around dock.																		Deploy underwater detection system if intel warrants.				
									Routine shipboard security rounds to involve observing water around ship, including any suspicious activity that could be divers.																						
									Develop local community awareness of any diving operations in area.																						
									Conduct underwater inspections if suspicious activity observed or if MARSEC increased.									Underwater inspection every week.													

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Sabotage	Bomb Aboard intended to breach cargo. Ship retains propulsion maneuverability	Along entire track leg 1 and along track leg 2 to position abeam of Lighted Buoy 4	Breach along this offshore leg of the track line towards the Columbia River mouth is beyond any zone of concern touching land. Nearest point of land is 4400yds ((4023m) from outer tip of south jetty , 4850yds (4435m) from outer most tip off south jetty, and 5700yds (5212m) from actual nearest point of land which is western tip of Cape Disappointment State Park.	Double hull Restricted / difficult access to outer cargo tank space between hulls – space is inerted. Shipboard security plan required to be in effect.					Periodic security boardings conducted prior to entry into port.																						
			No one of concern overlap with land	Crews vetted when submitting Advanced Notice of Arrival to Columbia River	1	3			Periodic POSCON boarding.	1	2			2	2			Ship security heightens in response to increased MARSEC.	2	1			3	1			Ship security tightens in response to increased MARSEC.	3	1		
				Electronic sensors aboard ship to detect cargo leaks/releases and set off alarms														Increased frequency of Security Boardings and POSCON Boardings on inbound LNG ships.									Security Boardings and POSCON boardings on all inbound LNG ships.				
		Along track leg 2, from buoy 4, track leg 3, track leg 4, and 5.	Ships following these track legs transit within 1200 yds (1097m) of the north jetty 1600yds (1463m) of the southernmost tip off Cape Disappointment and 700 yds (640m) of Jetty A the end of this track segment approaches to 1800 yds (1646m) of northern tip of Clatsop Spit and 1400 yds (1280m) off southern end of Sand Is. Breach of cargo tank while ship is on this part of the track line will result in following zone of concern overlaps:	Double hull Restricted / difficult access to outer cargo tank space between hulls – space is inerted.														Ship security heightens in response to increased MARSEC.													
			one 2 3 Low population (north etty etty A southern tip of Sand Island and approx 2 yds of northern tip of Clatsop Spit).	Shipboard security plan required to be in effect.	1	3	1	3	Periodic security boardings conducted prior to entry into port.	1	2	1	2	2	2	1	4	Increased frequency of Security Boardings and POSCON Boardings on inbound LNG ships.	2	1	1	2	3	1	1	3	Ship security tightens in response to increased MARSEC.	3	1	1	3
			Seasonal Cape Disappointment State Park will surge to about 5000 people in a day during summer season. (Ft Stevens will experience similar surge in visitors, but main concenration of people south of Jetty Lagoon.) **one 3 - Medium population (une through early Sept)**	Crews vetted when submitting Advanced Notice of Arrival to Columbia River	1	3	1	3	Periodic POSCON boardings conducted on inbound LNG ships.	1	2	1	2	2	2	1	4		2	1	1	2	3	1	1	3	Security Boardings and POSCON boardings on all inbound LNG ships.	3	1	1	3
			Seasonal The area along track legs 3, 4, & 5 could have very high density boating density during Buoy 10 fishing season in September. May have concentrations of 2K boats in a confined area. **one 1 Medium population (August)**	Electronic sensors aboard ship to detect cargo leaks/releases and set off alarms	1	3	3		Night transit during Buoy 10 season.	1	2	1	2	2	2	1	4		2	1	1	2	3	1	1	3		3	1	1	3
		Along track legs 6 & mid way through 7	Track line brings ship to within 650 yds (595m) off Clatsop Spit, 550yds (503m) off Hammond Marina Pt, and 400yds (366m) off Tansy Pt. Ft Stevens State Park population south of Jetty Lagoon increases to Medium in summer due to influx of campers/vacationers. (June to Sept) The summer influx of vacationers increases activity on he northern tip of Clatsop Spit but does not reach a Medium population density. The population of Warrenton also considered to increase to Medium density due to the influx of vacationers during that period.	Double hull Restricted / difficult access to outer cargo tank space between hulls – space is inerted. Shipboard security plan required to be in effect. Crews vetted when submitting Advanced Notice of Arrival to Columbia River					Periodic security boardings conducted prior to entry into port.									Ship security heightens in response to increased MARSEC.									Ship security tightens in response to increased MARSEC.				
			Clatsop Spit (North of etty Lagoon) **one 2 3 Low population**	Electronic sensors aboard ship to detect cargo leaks/releases and set off alarms	1	3	1	3	Periodic POSCON boardings on inbound LNG ships.	1	2	1	2	2	2	1	4	Increased frequency of Security Boardings and POSCON Boardings on inbound LNG ships.	2	1	1	2	3	1	1	3	Security Boardings and POSCON boardings on all inbound LNG ships.	3	1	1	3
			Hammond Marina Pt **one 1 Low population** **one 2 3 Med pop (summer)**		1	3	2	6	Estabish night time transit requirement during busiest fishing seasons (June - Sept)	1	2	2	4	2	2	2	8	Estabish night time transit requirement during busiest fishing seasons (June - Sept)	2	1	2	4	3	1	2	6	Estabish night time transit requirement during busiest fishing seasons (June - Sept)	3	1	2	6
			Tansy Pt **one 1 2 3 Low population** **one 1 2 3 - Medium population (summer)**		1	3	2	6		1	2	2	4	2	2	2	8		2	1	2	4	3	1	2	6		3	1	2	6

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)

	What If	Location	Consequence	Existing Safeguards	Initial Score[1] Threat	Initial Score[1] Vulnerability	Initial Score[1] Consequences	Initial Score[1] Risk	MARSEC - 1 Proposed Risk Management Strategies	M1 Ad usted Score Threat	M1 Ad usted Score Vulnerability	M1 Ad usted Score Consequences	M1 Ad usted Score Risk	M2 Initial Score Threat	M2 Initial Score Vulnerability	M2 Initial Score Consequences	M2 Initial Score Risk	MARSEC - 2 Proposed Risk Management Strategies	M2 Ad usted Score Threat	M2 Ad usted Score Vulnerability	M2 Ad usted Score Consequences	M2 Ad usted Score Risk	M3 Initial Score Threat	M3 Initial Score Vulnerability	M3 Initial Score Consequences	M3 Initial Score Risk	MARSEC - 3 Proposed Risk Management Strategies	M3 Ad usted Score Threat	M3 Ad usted Score Vulnerability	M3 Ad usted Score Consequences	M3 Ad usted Score Risk
Sabotage	Bomb Aboard intended to breach cargo Assume ship retains propulsion and maneuverability	Track leg 7 & 8 (upriver half of 7)	Breach while ship is turning or being maneuvered to pier with nearest point of land 620 yds (567m) at the eastern Skipanon peninsula could result in following Zone of Concern overlap (assumed ship a ship width off pier): **one 2 Low population** **one 3 Medium population (Astoria year round Warrenton in summer)**	Double hull Restricted / difficult access to outer cargo tank space between hulls – space is inerted. Shipboard security plan required to be in effect. CG Security boarding prior to entry into C River Crews vetted when submitting Advanced Notice of Arrival to Columbia River Electronic sensors aboard ship to detect cargo leaks/releases and set off alarms	1	3	1	3	Periodic security boardings conducted prior to entry into port. Periodic POSCON boardings on inbound LNG ships. Estabish night time transit requirement during busiest fishing seasons (June - Sept).	1	2	1	2	2	2	1	4	Ship security heightened in response to increased MARSEC. Increased frequency of Security Boardings and POSCON Boardings on inbound LNG ships. Estabish night time transit requirement during busiest fishing seasons (June - Sept)	2	1	1	2	3	1	1	3	Ship security heightened in response to increased MARSEC. Security Boardings and POSCON boardings on all inbound LNG ships. Estabish night time transit requirement during busiest fishing seasons (June - Sept).	3	1	1	3
	Bomb aboard ship during offload at pier	Dockside	Breach in fixed position at dock. Proposed pier position is approximately 560 yds (512m) from tip of Skipanon peninsula, 1700 yds (1555m) from Tansy Pt, and 2800yds (2560m) from nearest point of land at Astoria. **one 1 2 Low population** **one 3 Medium population**	Double hull Restricted / difficult access to outer cargo tank space between hulls – space is inerted. Shipboard security plan required to be in effect. Terminal security plan provides access securityfrom shore. Crews vetted when submitting Advanced Notice of Arrival to Columbia River	1	3	1	3	Port state control boardings inspecting vessels. Cargo transfer monitors.	1	2	1	2	2	2	1	4	Ship security heightens in response to increased MARSEC. Facility security heightened in response to heightened MARSEC.	2	1	1	2	3	1	1	3	Ship security tightens in response to increased MARSEC. Facility security heightened in response to heightened MARSEC. POSCON Team remains aboard until cargo transfer completed.	3	1	1	3

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Sabotage	Release of LNG (Mechanical release)	Along track legs 1-8	Not credible scenario while ship is underway. **Release of LNG by mechanical means (pumps) not going to provide the si e liquid pool modeled by Sandia to derive ones of Concern. Sandia models based on half of cargo tank dumped within 2-3 minutes. Would require pumps from several tanks a period of hours to create a liquid pool of sufficient si e to impact the shore.**	Shipboard security plan in effect (crew making security rounds) Established safety practices on LNG ships for securing cargo tank transfer pumps. Automatic alarms for activation of transfer pumps Electronic sensors aboard ship to detect cargo leaks/releases and set off alarms Requirement for ship to submit Advanced Notice of Arrival to Columbia River – crew vetted // verifies that all equipment in proper operating order (such as electronic alarm systems) Existing regulation to conduct safety boardings offshore if Certificate of Compliance expired	1	1	1	1	Periodic security boardings conducted prior to entry into River. Periodic POSCON boardings on inbound LNG ships.	1	1	1	1	2	1	1	2	Ship security heightens in response to increased MARSEC. Increased frequency of Security Boardings and POSCON Boardings on inbound LNG ships.	2	1	1	2	3	1	1	3	Ship security tightens in response to increased MARSEC. Security Boardings and POSCON boardings on all inbound LNG ships.	3	1	1	3
	Release of LNG (Mechanical release)	Dockside	The level of supervision during offload operations makes this a very unlikely scenario. The pumps would not be able to discharge as much LNG as modeled to create the Sandia size spills and the detection systems would alarm. Numerous shutdown systems. Breach in fixed position at dock. Proposed pier position is approximately 560 yds (512m) from tip of Skipanon peninsula, 1700 yds (1555m) from Tansy Pt, and 2800yds (2560m) from nearest point of land at Astoria. **one 1 2 Low population** **one 3 Medium population**	Shipboard security plan required to be in effect. Crews vetted when submitting Advanced Notice of Arrival to Columbia River Very regimented safety precautions/procedures for conducting and monitoring offload operations Regs that require CG inspection of cargo transfer equipment and monitor tranfers Automatic electronic sensors to detect LNG leaks Automatic shutdown systems and manual systems	1	2	1	2	Periodic security boardings conducted prior to entry into port. Periodic POSCON boarding. 24 hr video surveillance coverage of dock area. Routine security rounds by terminal personnel to include o observation of water around dock and ship. Routine shipboard security rounds to involve observing water around ship, including any suspicious activity that could be divers.	1	1	1	1	2	1	1	2	Ship and vessel heightened security plan IAW MARSEC Level.	2	1	1	2	3	1	1	3	Ship and vessel heightened security plan IAW MARSEC Level. POSCON Team to remain on vessel until offload of cargo completed.	3	1	1	3

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Hi ack	High speed collision into cruise ship or large passenger vessel with loaded inbound LNG ship. detonate bomb to ensure cargo breach	Along track legs 2-7	**one 1 key asset** Scenario has very little credibilty due to difficulty planning and excuting the meeting of two ships underway.	Double hull Compulsory pilots on cruise ships and proposed LNG ships Shipboard security plan required to be in effect on both vessels. Established procedure fo ANOA/ANE which permits CG to vet crew prior to entry into Columbia River Security zone established around cruise ships in Columbia River Shipboard Security Alert System (SSAS) installed on LNG ships	1	2	3	6	Establish vessel management policy to prevent meeting / passing situations of cruise ships and inbound LNG tankers. Periodic security boardings conducted prior to entry into port. Periodic positive control boardings. Two tug escort of LNG ship from entrance to turning basin for mooring. Establish pilot duress code.	1	1	1	1	2	1	1	2	Ship security heightens in response to increased MARSEC. Increased frequency of Security Boardings and POSCON Boardings on inbound LNG ships.	2	1	1	2	3	1	1	3	Ship security heightens in response to increased MARSEC. Security and POSCON Boardings on all inbound LNG ships.	3	1	1	3
Hi ack	Ram Facility Moorings	Skipanon Terminal Dock (without ship present)	Not very credible scenario since damage relatively limited for the level of sophistication of attack. Breach in fixed position at dock. Proposed pier position is approximately 560 yds (512m) from tip of Skipanon peninsula, 1700 yds (1555m) from Tansy Pt, and 2800yds (2560m) from nearest point of land at Astoria. **one 1 2 Low population** **one 3 Medium population**	Double hull Compulsory pilots on cruise ships and proposed LNG ships Shipboard security plan required to be in effect. Tugs will be on scene to maneuver ship. Established procedure fo ANOA/ANE which permits CG to vet crew prior to entry into Columbia River Shipboard Security Alert System (SSAS) installed on LNG ships	1	3	1	3	Periodic security boardings conducted prior to entry into port. Periodic positive control boardings Two tugs to meet ship at river mouth to escort ship to dock. At least one of the tugs will be tethered to the ship. Another tug to meet ship at terminal to assist maneuvering ship. Establish pilot duress code	1	1	1	1	2	1	1	2	Increased frequency of Security Boardings and POSCON Boardings on inbound LNG ships. Ship security heightens in response to increased MARSEC.	2	1	1	2	3	1	1	3	Security and POSCON Boardings on all inbound LNG ships. Ship security heightens in response to increased MARSEC.	3	1	1	3
Hi ack	Drive Ship up river to Astoria to work in con unction with a smallboat carrying explosives to breach cargo tank(s)	Alongside a moored cruise ship	LNG ship hijacked and taken further up river towards Astoria when cruise ship in port. Maximum effect would be achieved if smallboat detonated alongside LNG ship or other means of breach of cargo tank. **one 1 ey Asset High population density**	Double hull Compulsory pilots on cruise ships and proposed LNG ships Shipboard Security Alert System (SSAS) installed on LNG ships Shipboard security plan required to be in effect. Established procedure fo ANOA/ANE which permits CG to vet crew prior to entry into Columbia River	1	3	3		Periodic security boardings conducted prior to entry into port. Periodic positive control boardings. Two tugs to meet ship at river mouth to escort ship to dock. One tug to be tethered. Another tug to meet ship at terminal to assist maneuvering ship. Establish pilot duress code.	1	1	3	3	2	1	3	6	Increased frequency of Security Boardings and POSCON Boardings on inbound LNG ships. Ship security heightens in response to increased MARSEC. Two tugs to meet ship at river mouth to escort ship to dock. One tug to be tethered. Another tug to meet ship at terminal to assist maneuvering ship.	2	1	3	6	3	1	3		Security and POSCON Boardings on all inbound LNG ships. Ship security heightens in response to increased MARSEC. Establish Policy that LNG ship not permitted in port while cruise ship at dock. Two tugs to meet ship at river mouth to escort ship to dock. One tug to be tethered. Another tug to meet ship at terminal to assist maneuvering ship.	3	1	1	3

Columbia River Entrance to Skipanon Security Scenarios (Track Legs 1 8)					Initial Score[1]				MARSEC - 1	M1 Ad usted Score				M2 Initial Score				MARSEC - 2	M2 Ad usted Score				M3 Initial Score				MARSEC - 3	M3 Ad usted Score			
	What If	Location	Consequence	Existing Safeguards	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk	Threat	Vulnerability	Consequences	Risk	Proposed Risk Management Strategies	Threat	Vulnerability	Consequences	Risk
Hi ack	Drive Ship up river to Astoria to work in con unction with a smallboat carrying explosives to breach cargo tank(s)	Under the Astoria-Meglar Bridge / Astoria waterfront	Hijacked ship moves upriver to ram into bridge structure or waterfront near bridge and then detonated by a bomb aboard or smallboat alongside LNG ship.	Double hull					Periodic security boardings conducted prior to entry into port.									Increased frequency of Security Boardings and POSCON Boardings on inbound LNG ships.									Security and POSCON Boardings on all inbound LNG ships.				
			one 1 Critical infrastructure Medium population	Compulsory pilots on cruise ships and proposed LNG ships					Periodic positive control boardings									Ship security heightens in response to increased MARSEC.									Ship security heightens in response to increased MARSEC.				
			one 2 Medium population	Shipboard security plan required to be in effect.	1	3	3		Two tugs to meet ship at river mouth to escort ship to dock. One tug to be tethered.	1	1	3	3	2	1	3	6	Two tugs to meet ship at river mouth to escort ship to dock. One tug to be tethered.	2	1	3	6	3	1	3		Two tugs to meet ship at river mouth to escort ship to dock. One tug to be tethered.	3	1	3	
				Established procedure fo ANOA/ANE which permits CG to vet crew prior to entry into Columbia River					Another tug to meet ship at terminal to assist maneuvering ship.									Another tug to meet ship at terminal to assist maneuvering ship.									Another tug to meet ship at terminal to assist maneuvering ship.				
				Shipboard Security Alert System (SSAS) installed on LNG ships					Establish pilot duress code																						
		Take ship up river to Portland and detonate in heavy population area	**Not credible scenario. Length of transit up river absence of river pilot etc..**	Double hull Compulsory pilots on cruise ships and proposed LNG ships Shipboard security plan required to be in effect. Established procedure fo ANOA/ANE which permits CG to vet crew prior to entry into Columbia River Shipboard Security Alert System (SSAS) installed on LNG ships		N	C				N	C			N	C				N	C			N	C				N	C	

Cumulative - Accidental Risk Assessment

Track from 12nm offshore to dock

(P – Probability; C – Consequence; R – Risk)

	Unmitigated				Mitigated			
Scenarios/Specific Location	**P**	**C**	**R**	**Action**	**P**	**C**	**R**	**Action**
Groundings								
South side of S Jetty @30ft depth	1	1	1	Document	1	1	1	Document
1500yds off Ft Stevens beach	1	N/A	N/A	Document	1	N/A	N/A	Document
1300yds off beach at Seaview	1	N/A	N/A	Document	1	N/A	N/A	Document
N Jetty inside mouth of River (summer)	2	3	6	Mitigate	1	1	1	Document
N Jetty inside mouth of River (winter)	2	1	2	Document	1	1	1	Document
South Jetty inside mouth of river	2	1	2	Document	1	1	1	Document
From track Leg 3 to dock	2	N/A	N/A	Document	1	N/A	N/A	Document
Collision (Low speed)								
Entire Track	1	N/A	N/A	Document	1	N/A	N/A	Document
Collision (High Speed)								
Entrance Range Channel	1	1	1	Document	1	1	1	Document
Track leg 4 – south of Jetty A	1	1	1	Document	1	1	1	Document
- Buoy 10 season pop	1	3	3	Consider	1	1	1	Document
Track leg 5-betw Sand Is & Clatsop	1	1	1	Document	1	1	1	Document
Track leg 6 passing Clatsop Spit	1	1	1	Document	1	1	1	Document
Track leg 6-off Hammond Marina (summer)	1	2	2	Document	1	2	2	Document
Track leg 6-off Tansy Pt (summer)	1	2	2	Document	1	2	2	Document
Track leg 7/8	1	1	1	Document	1	1	1	Document
Allision with dock	1	N/A	N/A	Document	1	N/A	N/A	Document
Cargo handling Mishap	1	1	1	Document	1	1	1	Document

Cumulative - Accidental Risk Assessment

Track from 12nm offshore to dock

(P – Probability; C – Consequence; R – Risk)

	Unmitigated				Mitigated			
Scenarios/Specific Location	**P**	**C**	**R**	**Action**	**P**	**C**	**R**	**Action**
Ship breaks moorings from dock	1	N/A	N/A	Document	1	1	1	Document
Light Aircraft crashes into ship	1	1	1	Document	1	1	1	Document

Notes:
(Probability Score Criteria: 1 = Low; 2 = Medium; 3 – High)
(Consequence Score: 0 = Very Low/Breech over water only; 1 = Low; 2 = Medium; 3 = High; N/A = No cargo tank breach)

Cumulative - MARSEC 1 Intentional Risk Assessment

Scenarios	Unmitigated (Contains existing measures) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Surface – Small boat attack										
Track leg 1 & 2 – 12nm off shore to Buoy 4	1	3	0	0	Document	1	2	0	0	Doc
Track leg 2 from Buoy 4 thru leg 5	1	4	1	4	Document	1	3	1	3	Doc
Seasonal: Cape Disappointment State Park	1	4	1	4	Document	1	3	1	3	Doc
Seasonal: Heaviest Fishing Seasons	1	4	3	12	Mitigate	1	3	1	3	Doc
Track leg 6 and midway through leg 7	1	4	1	4	Document	1	3	1	3	Doc
Seasonal: Track Leg 6 & 7 between Hammond and Tansy Points	1	4	2	8	Mitigate	1	3	2	6	Con
Track leg 7 & 8 where ship is maneuvered to dock	1	4	1	4	Document	1	3	1	3	Doc
Dockside	1	4	1	4	Document	1	3	1	3	Doc
-with barrier						1	1	1	1	Doc
Surface - Ship Ramming										
Track leg 1 – 12nm off shore	1	2	0	0	Document	1	2	0	0	Doc
Track leg 2 to Buoy 4	1	3	0	0	Document	1	3	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	1	3	1	3	Document	1	2	1	2	Doc
Seasonal: Cape Disappointment State Park	1	3	2	6	Consider	1	2	1	2	Doc
Seasonal: Heaviest Fishing Seasons	1	3	3	9	Mitigate	1	2	1	2	Doc
Track leg 6 passing Clatsop Spit	1	3	1	3	Document	1	2	1	2	Doc
Seasonal: Track legs 6 & 7 between Hammond & Tansy Pts	1	3	2	6	Consider	1	2	2	4	Doc
Track leg 7 & 8 where ship is maneuvered to dock	1	4	1	4	Document	1	2	1	2	Doc
Dockside	1	4	1	4	Document	1	3	1	3	Doc
Projectile – From boat										
Track leg 1 & 2 – 12nm off shore to Buoy 4	1	4	0	0	Document	1	4	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	1	4	1	4	Document	1	3	1	3	Doc
Seasonal: Cape Disappointment State Park	1	4	1	4	Document	1	3	1	3	Doc
Seasonal: Heaviest Fishing Seasons	1	4	3	12	Mitigate	1	3	1	3	Doc

Cumulative - MARSEC 1 Intentional Risk Assessment

Scenarios	Unmitigated (Contains existing measures) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Track leg 6 passing Clatsop Spit	1	4	1	4	Document	1	3	1	3	Doc
Seasonal: Track legs 6 & 7 passing Hammond & Tansy Pts	1	4	2	8	Mitigate	1	3	2	6	Con
Track leg 8 where ship is maneuvered to dock	1	4	1	4	Document	1	3	1	3	Doc
Dockside without boat barrier	1	4	1	4	Document	1	3	1	3	Doc
1 with boat barrier						1	2	1	2	Doc
Projectile - From shore										
Hammond marina	1	2	2	4	Document	1	1	2	2	Doc
Tansy Pt / Nygard Dock	1	4	2	8	Mitigate	1	1	2	2	Doc
Aerial – Small Aircraft										
Track leg 1 & 2 – 12nm off shore to Buoy 4	1	4	0	0	Document	1	4	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	1	4	1	4	Document	1	4	1	4	Doc
Track legs 3-5 during Buoy 10 season	1	4	3	12	Mitigate	1	4	1	4	Doc
Track leg 6 passing Clatsop Spit	1	4	1	4	Document	1	4	1	4	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	1	4	2	8	Mitigate	1	4	2	8	Mit
Track leg 8 where ship is maneuvered to dock	1	4	1	4	Document	1	4	1	4	Doc
Dockside – without boat barrier	1	4	1	4	Document	1	4	1	4	Doc
- with barrier						1	3	1	3	Doc
Aerial - Commercial aircraft										
Track leg 1 & 2 – 12nm off shore to Buoy 4	1	1	0	0	Document	1	1	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	1	1	1	1	Document	1	1	1	1	Doc
Track legs 3-5 during Buoy 10 season	1	1	3	3	Document	1	1	1	1	Doc
Track leg 6 passing Clatsop Spit	1	1	1	1	Document	1	1	1	1	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	1	1	2	2	Document	1	1	2	2	Doc

Cumulative - MARSEC 1 Intentional Risk Assessment

Scenarios	Unmitigated (Contains existing measures) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Track leg 8 where ship is maneuvered to dock	1	1	1	1	Document	1	1	1	1	Doc
Dockside – without or with boat barrier	1	1	1	1	Document	1	1	1	1	Doc
Underwater - Mines										
Track leg 1 & 2 – 12nm off shore to Buoy 4	1	1	0	0	Document	1	1	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	1	3	1	3	Document	1	2	1	2	Doc
Track legs 3-5 during Buoy 10 season (night)	1	3	3	9	Mitigate	1	2	1	2	Doc
Track leg 6 passing Clatsop Spit	1	3	1	3	Document	1	2	1	2	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	1	3	2	6	Consider	1	2	2	4	Doc
Track leg 8 where ship is maneuvered to dock	1	2	1	2	Document	1	1	1	1	Doc
Underwater - Divers										
Dockside only -not credible when ship underway	1	3	1	3	Document	1	2	1	2	Doc
Sabotage – Bomb Placed Aboard Ship										
Track leg 1 & 2 – 12nm off shore to Buoy 4	1	3	0	0	Document	1	2	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	1	3	1	3	Document	1	2	1	2	Doc
Track legs 3-5 during Buoy 10 season (night)	1	3	3	9	Mitigate	1	2	1	2	Doc
Track leg 6 passing Clatsop Spit	1	3	1	3	Document	1	2	1	2	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	1	3	2	6	Consider	1	2	2	4	Doc
Track leg 8 where ship is maneuvered to dock	1	3	1	3	Document	1	2	1	2	Doc
Dockside	1	3	1	3	Document	1	2	1	2	Doc
Sabotage - Intentional Release										
Ship Underway	1	1	1	1	Document	1	1	1	1	Doc
Dockside	1	2	1	2	Document	1	1	1	1	Doc

Cumulative - MARSEC 1 Intentional Risk Assessment

Scenarios	Unmitigated (Contains existing measures) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Hijack - Ram cruise ship underway										
Entire track	1	2	3	6	Consider	1	1	1*	1	Doc
Hijack - Ram LNG Facility	1	3	1	3	Document	1	1	1	1	Doc
Hijack - Ram cruise ship @ Astoria dock	1	3	3	9	Mitigate	1	1	3	3	Doc
Hijack - Target Astoria-Meglar Bridge	1	3	3	9	Mitigate	1	1	3	3	Doc

Notes:

Threat scores = High – 1; Medium – 2; Low – 1

Vulnerability scores = High-4; Medium-3; Low—2; Very Low-1

Consequence scores = High-3; Medium-2; Low-1 (N/A – no cargo breech // 0 – Incident off shore - zones do not reach land)

* Consequence reduced as well as vulnerability to better reflect mitigation action of eliminating LNG/cruise ship meeting situations. Vulnerability and consequence both reduced due to fact that target no longer available.

Cumulative - MARSEC 2

Intentional Risk Assessment

Scenarios	Unmitigated (Contains MARSEC 1 mitigation) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Surface – Small boat attack										
Track leg 1 & 2 – 12nm off shore to Buoy 4	2	2	0	0	Document	2	2	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	2	3	1	6	Consider	2	2	1	4	Doc
Track legs 3-5 during Buoy 10 season (night)	2	3	1	6	Consider	2	2	1	4	Doc
Track leg 6 passing Clatsop Spit	2	3	1	6	Consider	2	2	1	4	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	2	3	2	12	Mitigate	2	1*	2	4	Doc
Track leg 8 where ship is maneuvered to dock	2	3	1	6	Consider	2	2	1	4	Doc
Dockside – Score for without/with boat barrier	2	3	1	6	Consider	2	2	1	4	Doc
						2	1	1	2	Doc
Surface - Ship Ramming										
Track leg 1 – 12nm off shore to Buoy 4	2	2	0	0	Document	2	2	0	0	Doc
Track leg 2 to Buoy 4	2	3	0	0	Document	2	3	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	2	2	1	4	Document	2	1	1	2	Doc
Track legs 3-5 during Buoy 10 season (night)	2	2	1	4	Document	2	1	1	2	Doc
Track leg 6 passing Clatsop Spit	2	2	1	4	Document	2	1	1	2	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	2	2	2	8	Mitigate	2	1	2	4	Doc
Track leg 8 where ship is maneuvered to dock	2	2	1	4	Document	2	1	1	2	Doc
Dockside	2	3	1	6	Consider	2	2	1	4	Doc
Projectile – From boat										
Track leg 1 & 2 – 12nm off shore to Buoy 4	2	4	0	0	Document	2	4	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	2	3	1	6	Consider	2	2	1	4	Doc
Track legs 3-5 during Buoy 10 season (night)	2	3	1	6	Consider	2	2	1	4	Doc
Track leg 6 passing Clatsop Spit	2	3	1	6	Consider	2	2	1	4	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	2	3	2	12	Mitigate	2	1*	2	4	Doc
Track leg 8 where ship is maneuvered to dock	2	3	1	6	Consider	2	2	1	4	Doc
Dockside	2	3	1	6	Consider	2	2	1	4	Doc

Cumulative - MARSEC 2

Intentional Risk Assessment

Scenarios	Unmitigated (Contains MARSEC 1 mitigation) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Projectile - From shore										
Hammond marina	2	1	2	4	Document	2	1	2	4	Doc
Tansy Pt / Nygard Dock	2	1	2	4	Document	2	1	2	4	Doc
Aerial – Small Aircraft										
Track leg 1 & 2 – 12nm off shore to Buoy 4	2	4	0	0	Document	2	4	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	2	4	1	8	Mitigate	2	4	1	8	Mit
Track legs 3-5 during Buoy 10 season	2	4	1	8	Mitigate	2	4	1	8	Mit
Track leg 6 passing Clatsop Spit	2	4	1	8	Mitigate	2	4	1	8	Mit
Track legs 6 & 7 passing Hammond & Tansy Pts	2	4	2	16	Mitigate	2	4	2	16	Mit
Track leg 8 where ship is maneuvered to dock	2	4	1	8	Consider	2	4	1	8	Mit
Dockside – Score for without boat barrier	2	4	1	8	Mitigate	2	4	1	8	Mit
-with barrier						2	3	1	6	Con
Aerial - Commercial aircraft										
Track leg 1 & 2 – 12nm off shore to Buoy 4	2	1	0	0	Document	2	1	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	2	1	1	2	Document	2	1	1	2	Doc
Track legs 3-5 during Buoy 10 season	2	1	3	6	Mitigate	2	1	1	2	Doc
Track leg 6 passing Clatsop Spit	2	1	1	2	Document	2	1	1	2	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	2	1	2	4	Document	2	1	2	4	Doc
Track leg 8 where ship is maneuvered to dock	2	1	1	2	Document	2	1	1	2	Doc
Dockside – Score for without/with boat barrier	2	1	1	2	Document	2	1	1	2	Doc

Cumulative - MARSEC 2

Intentional Risk Assessment

Scenarios	Unmitigated (Contains MARSEC 1 mitigation) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Underwater - Mines										
Track leg 1 & 2 – 12nm off shore to Buoy 4	2	1	0	0	Document	2	1	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	2	2	1	4	Document	2	1	1	2	Doc
Track legs 3-5 during Buoy 10 season (night)	2	2	1	4	Document	2	1	1	2	Doc
Track leg 6 passing Clatsop Spit	2	2	1	4	Document	2	1	1	2	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	2	2	2	8	Document	2	1	2	4	Doc
Track leg 8 where ship is maneuvered to dock	2	1	1	2	Document	2	1	1	2	Doc
Underwater - Divers										
Dockside only -not credible when ship underway	2	2	1	4	Document	2	1	1	2	Doc
Sabotage – Bomb Placed Aboard Ship										
Track leg 1 & 2 – 12nm off shore to Buoy 4	2	2	0	0	Document	2	1	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	2	2	1	4	Document	2	1	1	2	Doc
Track legs 3-5 during Buoy 10 season (night)	2	2	1	4	Document	2	1	1	2	Doc
Track leg 6 passing Clatsop Spit	2	2	1	4	Document	2	1	1	2	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	2	2	2	8	Mitigate	2	1	2	4	Doc
Track leg 8 where ship is maneuvered to dock	2	2	1	4	Document	2	1	1	2	Doc
Dockside	2	2	1	4	Document	2	1	1	2	Doc
Sabotage - Intentional Release										
Underway	2	1	1	2	Document	2	1	1	2	Doc
Dockside	2	1	1	2	Document	2	1	1	2	Doc
Hijack - Ram cruise ship										
Entire track	2	1	1**	2	Document	2	1	1**	2	Doc

Cumulative - MARSEC 2

Intentional Risk Assessment

Scenarios	Unmitigated (Contains MARSEC 1 mitigation) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Hijack - Ram LNG Facility	2	2	1	4	Document	2	1	1	2	Doc
Hijack - Ram cruise ship @ Astoria dock	2	1	3	6	Consider	2	1	3	6	Con
Hijack - Target Astoria-Meglar Bridge	2	1	3	6	Consider	2	1	3	6	Con

Notes:
Threat Scores = High – 3; Medium – 2; Low – 1
Vulnerability Scores = High-4; Medium-3; Low-2; Very Low-1
Consequence Scores = High – 3; Medium – 2; Low - 1 (N/A – no cargo breech // 0 - Incident offshore/zones do not reach land)

*Reflects different level of security zone/escort requirements than other areas of transit.
** Reflects previous reduction in Consequence in MARSEC 1 for eliminating cruise ship target by preventing meeting/passing situations in addition to reducing vulnerability.

Cumulative - MARSEC 3

Intentional Risk Assessment

Scenarios	Unmitigated (Contains MARSEC 2 mitigation) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Surface – Small boat attack										
Track leg 1 & 2 – 12nm off shore to Buoy 4	3	2	0	0	Document	3	2	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	3	2	1	6	Consider	3	1	1	3	Doc
Track legs 3-5 during Buoy 10 season (night)	3	2	1	6	Consider	3	1	1	3	Doc
Track leg 6 passing Clatsop Spit	3	2	1	6	Consider	3	1	1	3	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	3	1	2	6	Consider	3	1	2	6	Con
Track leg 8 where ship is maneuvered to dock	3	2	1	6	Consider	3	1	1	3	Doc
Dockside – Score for without	3	2	1	6	Consider	3	1	1	3	Doc
-with barrier						3	1	1	3	Doc
Surface - Ship Ramming										
Track leg 1 – 12nm off shore to Buoy 4	3	2	0	0	Document	3	2	0	0	Doc
Track leg 2 to Buoy 4	3	3	0	0	Document	3	3	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	3	1	1	3	Document	3	1	1	3	Doc
Track legs 3-5 during Buoy 10 season (night)	3	1	1	3	Document	3	1	1	3	Doc
Track leg 6 passing Clatsop Spit	3	1	1	3	Document	3	1	1	3	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	3	1	2	6	Consider	3	1	2	6	Con
Track leg 8 where ship is maneuvered to dock	3	1	1	3	Document	3	1	1	3	Doc
Dockside	3	2	1	6	Consider	3	1	1	3	Doc
Projectile – From boat										
Track leg 1 & 2 – 12nm off shore to Buoy 4	3	4	0	0	Document	3	4	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	3	2	1	6	Consider	3	1	1	3	Doc
Track legs 3-5 during Buoy 10 season (night)	3	2	1	6	Consider	3	1	1	3	Doc
Track leg 6 passing Clatsop Spit	3	2	1	6	Consider	3	1	1	3	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	3	1	2	6	Consider	3	1	2	6	Con
Track leg 7/8 where ship is maneuvered to dock	3	2	1	6	Consider	3	1	1	3	Doc
Dockside with or without barrier	3	2	1	6	Consider	3	1	1	3	Doc

Cumulative - MARSEC 3

Intentional Risk Assessment

Scenarios	Unmitigated (Contains MARSEC 2 mitigation) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Projectile - From shore										
Hammond marina	3	1	2	6	Consider	3	1	2	6	Con
Tansy Pt / Nygard Dock	3	1	2	6	Consider	3	1	2	6	Con
Aerial – Small Aircraft										
Track leg 1 & 2 – 12nm off shore to Buoy 4	3	4	0	0	Document	3	4	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	3	4	1	12	Mitigate	3	3	1	9	Mit
Track legs 3-5 during Buoy 10 season	3	4	1	12	Mitigate	3	3	1	9	Mit
Track leg 6 passing Clatsop Spit	3	4	1	12	Mitigate	3	3	1	9	Mit
Track legs 6 & 7 passing Hammond & Tansy Pts	3	4	2	24	Mitigate	3	3	2	18	Mit
Track leg 8 where ship is maneuvered to dock	3	4	1	12	Mitigate	3	3	1	9	Mit
Dockside – Score for without boat barrier	3	3	1	9	Mitigate	3	3	1	9	Mit
-with barrier						3	3	1	9	Mit
Aerial - Commercial aircraft										
Track leg 1 & 2 – 12nm off shore to Buoy 4	3	1	0	0	Document	3	1	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	3	1	1	3	Document	3	1	1	3	Doc
Track legs 3-5 during Buoy 10 season	3	1	1	3	Document	3	1	1	3	Doc
Track leg 6 passing Clatsop Spit	3	1	1	3	Document	3	1	1	3	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	3	1	2	6	Consider	3	1	2	6	Con
Track leg 8 where ship is maneuvered to dock	3	1	1	3	Document	3	1	1	3	Doc
Dockside – Score for without/with boat barrier	3	1	1	3	Document	3	1	1	3	Doc

Cumulative - MARSEC 3

Intentional Risk Assessment

Scenarios	Unmitigated (Contains MARSEC 2 mitigation) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Underwater - Mines										
Track leg 1 & 2 – 12nm off shore to Buoy 4	3	1	0	0	Document	3	1	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	3	1	1	3	Document	3	1	1	3	Doc
Track legs 3-5 during Buoy 10 season (night)	3	1	1	3	Document	3	1	1	3	Doc
Track leg 6 passing Clatsop Spit	3	1	1	3	Document	3	1	1	3	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	3	1	2	6	Consider	3	1	2	6	Con
Track leg 8 where ship is maneuvered to dock	3	1	1	3	Document	3	1	1	3	Doc
Underwater - Divers										
Dockside only -not credible when ship underway	3	1	1	3	Document	3	1	1	3	Doc
Sabotage – Bomb Placed Aboard Ship										
Track leg 1 & 2 – 12nm off shore to Buoy 4	3	2	0	0	Document	3	1	0	0	Doc
Track legs 2 from Buoy 4 thru leg 5	3	1	1	3	Document	3	1	1	3	Doc
Track legs 3-5 during Buoy 10 season (night)	3	1	1	3	Document	3	1	1	3	Doc
Track leg 6 passing Clatsop Spit	3	1	1	3	Document	3	1	1	3	Doc
Track legs 6 & 7 passing Hammond & Tansy Pts	3	1	2	6	Consider	3	1	2	6	Con
Track leg 8 where ship is maneuvered to dock	3	1	1	3	Document	3	1	1	3	Doc
Dockside	3	1	1	3	Document	3	1	1	3	Doc
Sabotage - Intentional Release										
Underway	3	1	1	3	Document	3	1	1	3	Doc
Dockside	3	1	1	3	Document	3	1	1	3	Doc
Hijack - Ram cruise ship										
Entire track	3	1	1	3	Document	3	1	1	3	Doc

Cumulative - MARSEC 3

Intentional Risk Assessment

Scenarios	Unmitigated (Contains MARSEC 2 mitigation) T	V	C	Risk	Action	Mitigated T	V	C	R	Act
Hijack - Ram LNG Facility	3	1	1	3	Document	3	1	1	3	Doc
Hijack - Ram cruise ship @ Astoria dock	3	1	3	9	Mitigate	3	1	1	3	Doc
Hijack - Target Astoria-Meglar Bridge	3	1	3	9	Mitigate	3	1	3	9	Mit

Notes:
Threat Scores = High – 3; Medium – 2; Low – 1
Vulnerability Scores = High-4; Medium-3; Low-2; Very Low-1
Consequence Scores = High – 3; Medium – 2; Low - 1 (N/A – no cargo breech // 0 - Incident offshore/zones do not reach land)

Oregon LNG Skipanon
WSA Workshop

October 31, 2007

Name	Organization/Agency	Phone	Cell	Email
CAPT Gary Lewin	Columbia River Bar Pilots	503-325-2643	503-440-2041	gslinc@pacifier.com
CAPT Robert Johnson	Columbia River Bar Pilots	503-325-2641		realjohn@pacifier.com
Mr. Preston Polasek	Warrenton City Manager	503-861-2233		citymanager@ci.warrenton.or.us
Chief Robert L. Maxfield	Warrenton Police Department	503-861-2235		maxfield@ci.warrenton.or.us
Chief Ted Ames	Warrenton Fire Department	503-861-2494		firechief@ci.warrenton.or.us
Mr. Keith V. Pinkstaff	Warrenton Harbormaster	503-861-3822		harbormaster@ci.warrenton.or.us
Mr Ron Larsen	Port of Astoria	503-325-4521		rlarsen@portofastoria.com
Chief Lenard Hansen	Astoria Fire Department	503-325-2345		lhansen@astoria.or.us
Asst Chief Mike Jackson	Astoria Fire Department	503-325-2345		mjackson@astoria.or.us
Deputy Sheriff Paul Williams	Clatsop County Sheriff	503-325-8635		pwilliams@co.clatsop.or.us
Mr Gene Strong	Clatsop County Emergency Mngmt Div	503-325-8635		gstrong@co.clatsop.or.us
Ms. Deanna Henry	Oregon State DOE	503-932-4428		deanna.henry@state.or.us
Mr Tad Pedersen	Oregon State Fire Marshall	503-325-5515, ext. 24		tad.pedersen@state.or.us
SGT Jeff Scroup	Oregon State Police	503-861-2926	503-791-5249	jeff.scroup@state.or.us
SGT Brad Rhoden	Washington Fish & Wildlife	360-249-6522, ext. 253		rhodeblr@dfw.wa.gov
Mr. Robert Rich	Shaver Transportation	503-228-8850		rdr@shavertransportation.com
LT Shadrack Scheirman	Coast Guard - Sector Portland	503-240-9307		shadrack.l.scheirman@uscg.mil
LT Bill Taylor	Coast Guard - Sector Portland	503-240-2594		william.e.taylor@uscg.mil
LCDR Matt McGlynn	Coast Guard - Group/Airsta Astoria	503-861-6246		matthew.r.mcglynn@uscg.mil
ENS Derek Schramel	Coast Guard - Group/Airsta Astoria	503-861-6133		derek.l.schramel@uscg.mil
Mr. Peter Hansen	Oregon LNG	503-298-4966	503-709-0610	peterh@OregonLNG.com
Mr John Compere	Oregon LNG	503-325-1010		jcompere@charter.net
Mr Jeff Ely	CH2M Hill	713-806-0161		jeff.ely@ch2m.com
Mr Scott Glover	Halcrow/HPA	703-481-2228		sglover@halcrow.com
Mr Dave Ryan	Halcrow/HPA	703-481-2228		RyanD@halcrow.com

OBSTRUCTIONS

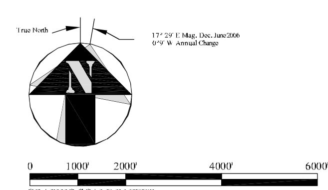
NO.	DECSCRIPTION	ELEV.	PENETRATION	SURFACE	DISPOSITION
OB1	LEVEE	15.6	4	PRIMARY	NONE
OB2	TREE	29.6	18	TRANS.	TRIM OR REMOVE
OB3	TREE	45.6	33	TRANS.	TRIM OR REMOVE
OB4	TREE	41.6	29	TRANS.	TRIM OR REMOVE
OB5	OL ON GS	55.6	43	PRIMARY	NONE
OB6	TREE	30.6	19	PRIMARY	TRIM OR REMOVE
OB7	BUSH	19.6	8	PRIMARY	TRIM OR REMOVE
OB8	BUSH	29.6	18	PRIMARY	TRIM OR REMOVE
OB9	TREE	28.6	16	PRIMARY	TRIM OR REMOVE
OB10	SIGN	18.6	5	PRIMARY	NONE
OB11	OL AMOM	34.6	21	TRANS.	NONE
OB12	SIGN	17.6	5	PRIMARY	NONE
OB13	SIGN	17.6	5	PRIMARY	NONE
OB14	BUSH	23.6	12	PRIMARY	TRIM OR REMOVE
OB15	TREE	23.6	11	PRIMARY	TRIM OR REMOVE
OB16	BUSH	22.6	10	PRIMARY	TRIM OR REMOVE
OB17	BUSH	19.6	7	PRIMARY	TRIM OR REMOVE
OB18	BUSH	19.6	7	PRIMARY	TRIM OR REMOVE
OB19	BUSH	23.6	10	8 APP.	TRIM OR REMOVE
OB20	OL ON LOC	15.6	0	8 APP.	NONE
OB21	ANT ON OL BLDG	22.6	6	8 APP.	NONE
OB22	TREE	97.6	33	8 APP.	TRIM OR REMOVE
OB23	TREE	125.6	28	8 APP.	TRIM OR REMOVE
OB24	TREE	125.6	19	8 APP.	TRIM OR REMOVE
OB25	TREE	119.6	6	8 APP.	TRIM OR REMOVE
OB26	TREE	121.6	−3	8 APP.	TRIM OR REMOVE
OB27	TREE	132.6	2	8 APP.	TRIM OR REMOVE
OB28	TREE	26.6	15	26 APP.	TRIM OR REMOVE
OB29	TREE	24.6	12	26 APP.	TRIM OR REMOVE
OB30	TREE	30.6	27	26 APP.	TRIM OR REMOVE
OB31	TREE	29.6	14	26 APP.	TRIM OR REMOVE
OB32	TREE	35.6	13	26 APP.	TRIM OR REMOVE
OB33	TREE	36.6	13	26 APP.	TRIM OR REMOVE
OB34	TREE	83.6	7	26 APP.	NONE
OB35	OL TRMSN TWR	205.6	−49	26 APP.	NONE
OB36	BUSH	18.6	−3	31 APP.	TRIM OR REMOVE
OB37	BUSH	19.6	5	13 APP.	TRIM OR REMOVE
OB38	BUSH	19.6	−8	13 APP.	TRIM OR REMOVE
OB39	BUSH	25.6	−4	13 APP.	TRIM OR REMOVE
OB40	BUSH	21.6	−8	13 APP.	NONE
OB41	TREE	28.6	−4	13 APP.	TRIM OR REMOVE
OB42	TREE	29.6	10	13 APP.	TRIM OR REMOVE
OB43	TREE	31.6	−14	13 APP.	NONE
OB44	ROAD(N)	32.6	−80	13 APP.	NONE
OB45	BUSH	27.6	−1	31 APP.	TRIM OR REMOVE
OB46	TREE	33.6	−3	31 APP.	TRIM OR REMOVE
OB47	TREE	92.6	0	31 APP.	NONE
OB48	TREE	124.6	−4	31 APP.	NONE
OB49	TREE	157.6	−11	31 APP.	NONE
OB50	TREE	46.6	5	TRANS.	TRIM OR REMOVE
OB51	TREE	34.6	15	TRANS.	TRIM OR REMOVE
OB52	OL VOR/DME	41.6	−26	TRANS.	NONE
OB53	TREE	55.6	1	TRANS.	TRIM OR REMOVE
OB54	APBN	85.6	−49	TRANS.	NONE
OB55	TREE	35.6	−1	TRANS.	TRIM OR REMOVE
OB56	ANT	76.6	−77	TRANS.	NONE
OB57	TREE	47.6	3	TRANS.	TRIM OR REMOVE
OB58	TREE	31.6	7	TRANS.	TRIM OR REMOVE
OB59	TREE	45.6	17	TRANS.	TRIM OR REMOVE
OB60	TREE	53.6	−8	TRANS.	TRIM OR REMOVE
OB61	BUSH	21.6	−1	13 APP.	TRIM OR REMOVE
OB62	BUSH	26.6	6	TRANS.	TRIM OR REMOVE
OB63	TREE	40.6	1	TRANS.	TRIM OR REMOVE
OB64	TREE	31.6	−1	13 APP.	TRIM OR REMOVE
OB65	TREE	38.6	16	TRANS.	TRIM OR REMOVE
OB66	LEVEE	16.6	−24	13 APP.	NONE
OB67	TREE	68.6	−7	TRANS.	NONE
OB68	WSK	28.6	0	PRIMARY	NONE
OB69	TREE	43.6	−12	TRANS.	TRIM OR REMOVE
OB70	TREE	51.6	32	TRANS.	TRIM OR REMOVE
OB71	TREE	70.6	19	TRANS.	TRIM OR REMOVE
OB72	TREE	36.6	−9	TRANS.	TRIM OR REMOVE
OB73	TREE	90.6	−4	TRANS.	NONE
OB74	TREE	107.6	−19	TRANS.	NONE
OB75	TREE	47.6	7	31 APP.	TRIM OR REMOVE
OB76	TREE	81.6	−2	TRANS.	NONE
OB77	TREE	90.6	−28	TRANS.	NONE
OB78	TREE	124.6	−17	TRANS.	NONE
OB79	TREE	123.6	−2	31 APP.	NONE
OB80	TREE	212.6	47	HORIZ.	NONE
OB81	TREE	118.6	19	TRANS.	NONE
OB82	TREE	182.6	17	HORIZ.	NONE
OB83	TREE	164.6	0	HORIZ.	NONE
OB84	TREE	163.6	9	HORIZ.	NONE
OB85	TREE	203.6	38	HORIZ.	NONE
OB86	TREE	270.6	105	HORIZ.	NONE
OB87	TREE	255.6	90	HORIZ.	NONE
OB88	OL TWR	210.6	45	HORIZ.	NONE
OB89	OL TWR	212.6	47	HORIZ.	NONE
OB90	STACK	210.6	45	HORIZ.	NONE
OB91	TREE	328.6	163	HORIZ.	NONE
OB92	TREE	388.6	150	CONICAL	NONE
OB93	TREE	340.6	175	HORIZ.	NONE
OB94	TREE	276.6	70	CONICAL	NONE
OB95	ANT ON TANK	500.6	299	CONCIAL	NONE
OB96	TREE	415.6	225	CONICAL	NONE
OB97	TREE	485.6	284	CONICAL	NONE
OB98	TREE	326.6	146	CONICAL	NONE
OB99	TREE	401.6	36	CONICAL	NONE
OB100	OL ON BRIDGE	364.6	52	CONICAL	NONE
OB101	TREE	418.6	134	CONICAL	NONE
OB102	TOWER	108.6	−52	26 APP.	NONE
OB103	TOWER	141.6	−23.3	HORIZ.	NONE
OB104	CATENARY	201.6	−22.4	26 APP.	NONE

OBSTRUCTIONS TAKEN FROM NOAA/NOS OC 24 (SURVEYED 6/96). ELEVATIONS CONVERTED TO NAVD88.

OBSTRUCTIONS 100–104 TAKEN FROM FAA DIGITAL OBSTRUCTION FILE.

OBSTRUCTING TREES/BUSHES WITHIN RUNWAY PRIMARY, APPROACH, AND ASSOCIATED TRANSITIONAL SURFACES TO BE TRIMMED OR REMOVED.

OBSTRUCTING TERRAIN, TREES, OR BUILDING AREA.



AIRPORT DATA

	EXISTING	FUTURE
AIRPORT ELEVATION (AMSL) NGVD29	14.9'	SAME
AIRPORT REFERENCE POINT (ARP) NAD 83	LAT. 46°09'28.7"N LON. 123°52'43.3"W	SAME SAME
AIRPORT REFERENCE CODE	B–II	SAME
NPIAS CATEGORY	GA	SAME
MEAN DAILY MAX. TEMPERATURE	69°F	SAME
TAXIWAY LIGHTING	MITL	SAME
TAXIWAY MARKING	C/L	SAME
AIRPORT & TERMINAL NAVAIDS	GPS, VOR	SAME

REMARKS

SOURCE:
1. USGS QUADRANGLE MAPS: ASTORIA, WARRENTON, GEARHART, OLNEY, CATHLAMET BAY, OR.
2. FAA FAR PART 77.25, OBJECT AFFECTING NAVIGABLE AIRSPACE, CIVIL AIRPORT IMAGINARY SURFACES.
3. RUNWAY COORDINATES AND ELEVATIONS FROM HLB & ASSOCIATES, INC. SURVEY 2004.

REVISIONS

NO.	DESCRIPTION	DATE
.		

NOTES

AIRPORT AIRSPACE PLAN
CONICAL SURFACE

Port of Astoria

Astoria Regional Airport
Astoria, Oregon

Barnard Dunkelberg & Company
1616 East 15th Street
Tulsa, Oklahoma 74120
918.585.8844

DATE: OCT. 2007 SCALE: 1" = 2000' SHEET 2 OF 9

Washington State Parks
In cooperation with TACOMA POWER PARKS
TACOMA PUBLIC UTILITIES

Options:
Start Page
Browse Maps
New Reservation
My Account
Help/Comments

Tools:
Site Availability
Park Availability

Information:
Reservation Policies
ADA Site List
Color Blind Assist
Browser Information
Privacy Information
Security Information
Tacoma Power

Cape Disappointment Map Browser

Map Information:

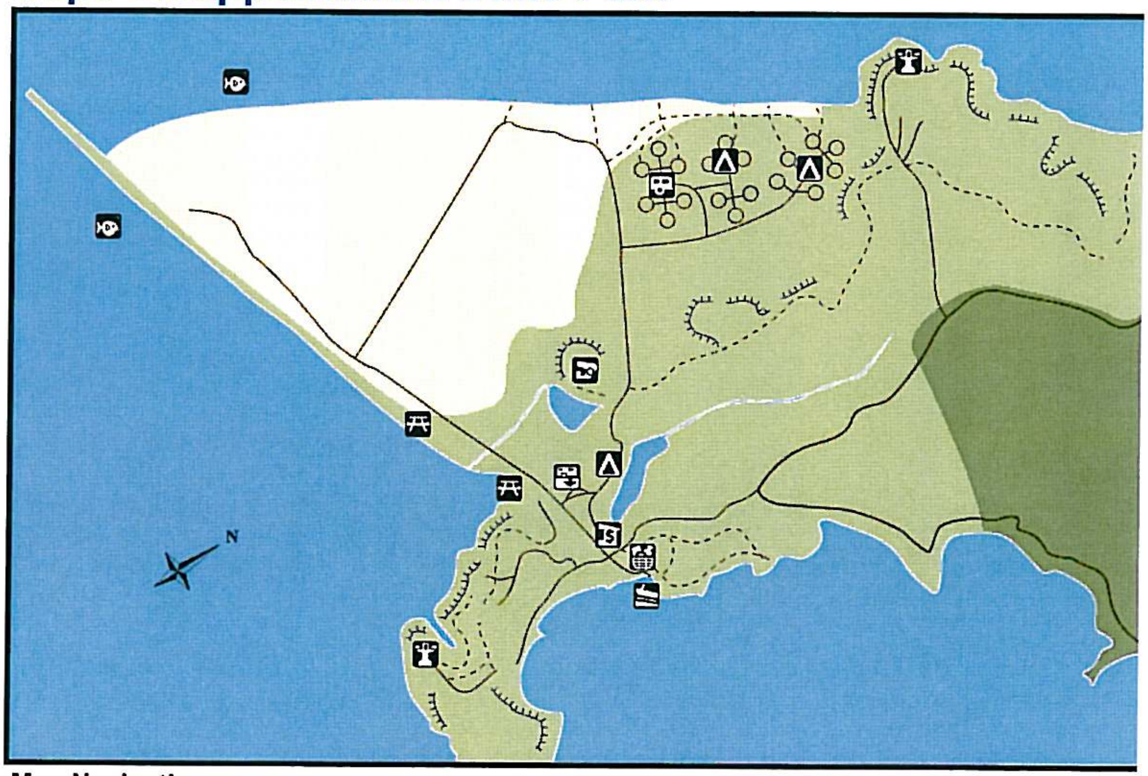
This map will show availability information once you have entered dates for your trip.
You can enter dates once you have selected a campsite, or you can select New Reservation in the left-hand menu to enter dates.

Map Navigation:
A (Sites 1-60)
B (Sites 61-120 including Yurts)
C (Sites 121-180)
D (Sites 181-250 and Cabins)
BACK TO: Southwest Region
BACK TO: Washington State Overview Map

Map Options:
Load A Campground By Clicking One Of These Images On The Map.

Campground
Primitive Service Campground
Serviced Campground
Click Here For Map Legend

Cape Disappointment State Park

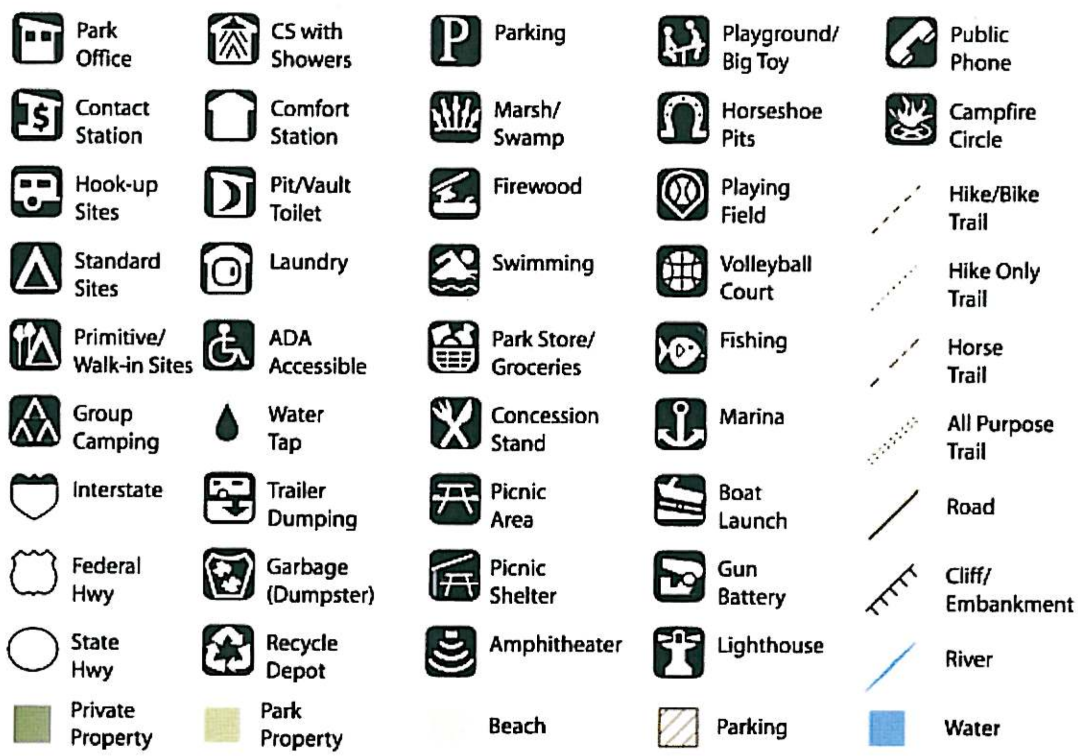


Map Navigation:
A (Sites 1-60) B (Sites 61-120 including Yurts) C (Sites 121-180) D (Sites 181-250 and Cabins) BACK TO: Southwest Region BACK TO: Washington State Overview Map

Washington State Parks

In cooperation with TACOMA POWER PARKS
TACOMA PUBLIC UTILITIES

Map Icons Legend



Washington State Parks
In cooperation with TACOMA POWER PARKS
TACOMA PUBLIC UTILITIES

Cape Disappointment Map Browser

Options:
Start Page
Browse Maps
New Reservation
My Account
Help/Comments

Tools:
Site Availability
Park Availability

Information:
Reservation Policies
ADA Site List
Color Blind Assist
Browser Information
Privacy Information
Security Information
Tacoma Power

Map Information:

This map will show availability information once you have entered dates for your trip.
You can enter dates once you have selected a campsite, or you can select New Reservation in the left-hand menu to enter dates.

Site Availability Legend:

Site numbers in GREEN are reservable.
Site numbers in RED are NOT available.
Site numbers in GREY are Non-Reservable.

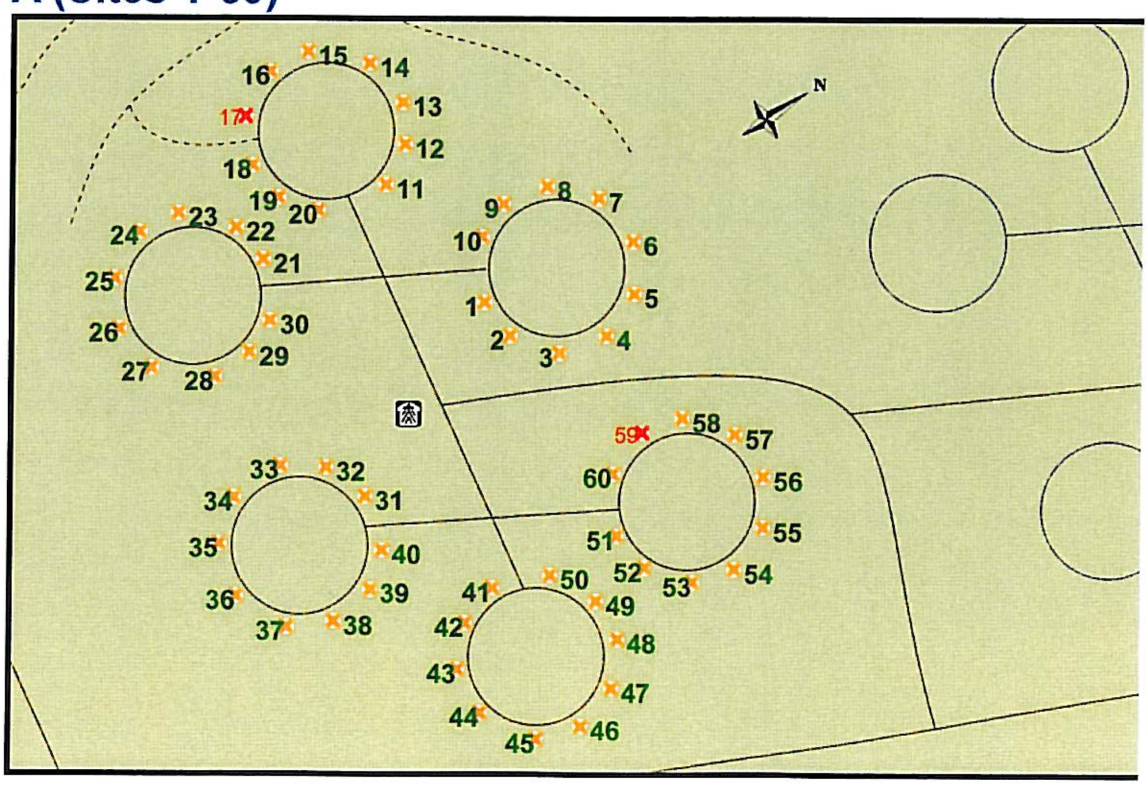
Site Icons Legend:

Sites shape indicates the maximum equipment the site can accommodate.	Tents	Trailers		
	Tents	<18ft	<32ft	>32ft
Booked/Closed Sites	●	▲	■	✖
Non-Reservable Sites	●	▲	■	✖
Available Sites				
Serviced Campsites	●	▲	■	✖

Map Navigation:
BACK TO: Cape Disappointment State Park
BACK TO: Washington State Overview Map

Map Options:
Click Here For Map Legend

A (Sites 1-60)



Washington State Parks
In cooperation with TACOMA POWER PARKS
TACOMA PUBLIC UTILITIES

Cape Disappointment Map Browser

Options:
Start Page
Browse Maps
New Reservation
My Account
Help/Comments

Tools:
Site Availability
Park Availability

Information:
Reservation Policies
ADA Site List
Color Blind Assist
Browser Information
Privacy Information
Security Information
Tacoma Power

Map Information:

This map will show availability information once you have entered dates for your trip.
You can enter dates once you have selected a campsite, or you can select New Reservation in the left-hand menu to enter dates.

Site Availability Legend:

Site numbers in GREEN are reservable.
Site numbers in RED are NOT available.
Site numbers in GREY are Non-Reservable.

Site Icons Legend:

Sites shape indicates the maximum equipment the site can accommodate.	Tents	Trailers		
	Tents	<18ft	<32ft	>32ft
Booked/Closed Sites	●	▲	■	✖
Non-Reservable Sites	●	▲	■	✖
Available Sites				
Standard Campsites	●	▲	■	✖
Serviced Campsites	●	▲	■	✖
Roofed Accommodations		⌂		

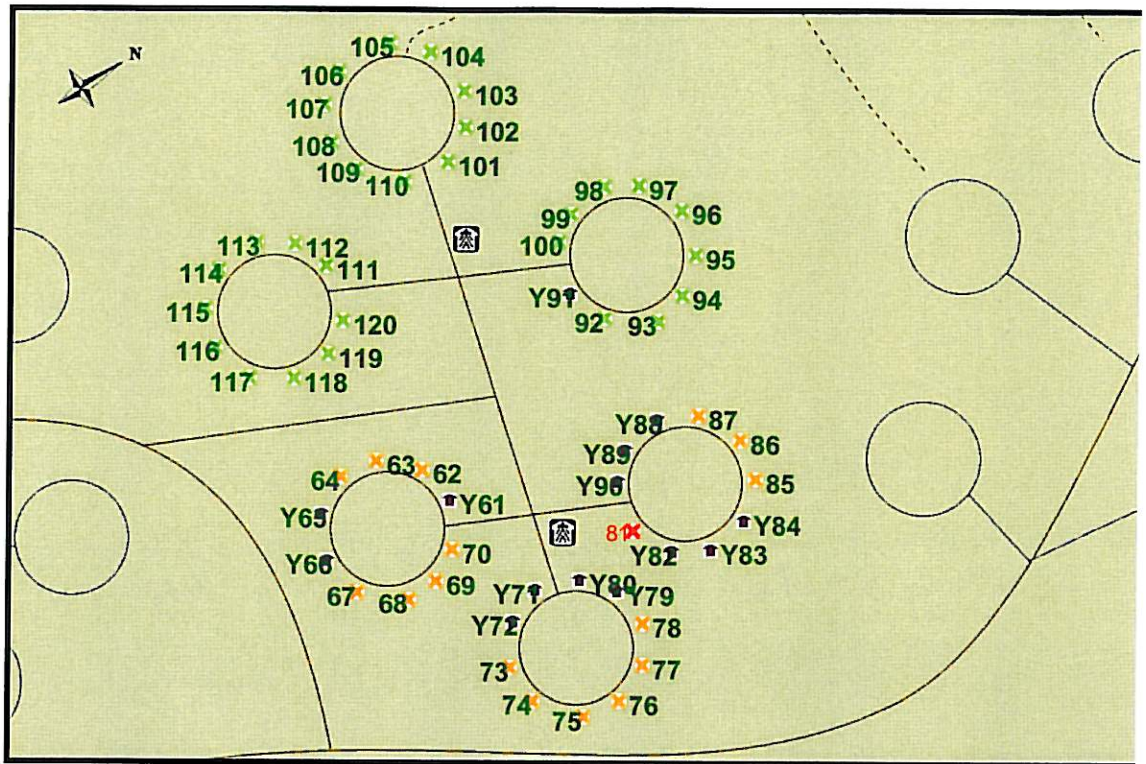
Map Navigation:

BACK TO: Cape Disappointment State Park
BACK TO: Washington State Overview Map

Map Options:

Click Here For Map Legend

B (Sites 61-120 including Yurts)



Map Navigation:

[BACK TO: Cape Disappointment State Park](#) [BACK TO: Washington State Overview Map](#)

[Back To Map](#)

Washington State Parks

In cooperation with TACOMA POWER PARKS
TACOMA PUBLIC UTILITIES

Cape Disappointment Map Browser

Options:

Start Page
Browse Maps
New Reservation
My Account
Help/Comments

Tools:

Site Availability
Park Availability

Information:

Reservation Policies
ADA Site List
Color Blind Assist
Browser Information
Privacy Information
Security Information
Tacoma Power

Map Information:

This map will show availability information once you have entered dates for your trip.
You can enter dates once you have selected a campsite, or you can select New Reservation in the left-hand menu to enter dates.

Site Availability Legend:

Site numbers in GREEN are reservable.
Site numbers in RED are NOT available.
Site numbers in GREY are Non-Reservable.

Site Icons Legend:

Sites shape indicates the maximum equipment the site can accommodate.	Tents	Trailers		
	Tents	<18ft	<32ft	>32ft
Booked/Closed Sites	●	▲	■	✕
Non-Reservable Sites	●	▲	■	✕
Available Sites				
Standard Campsites	●	▲	■	✕

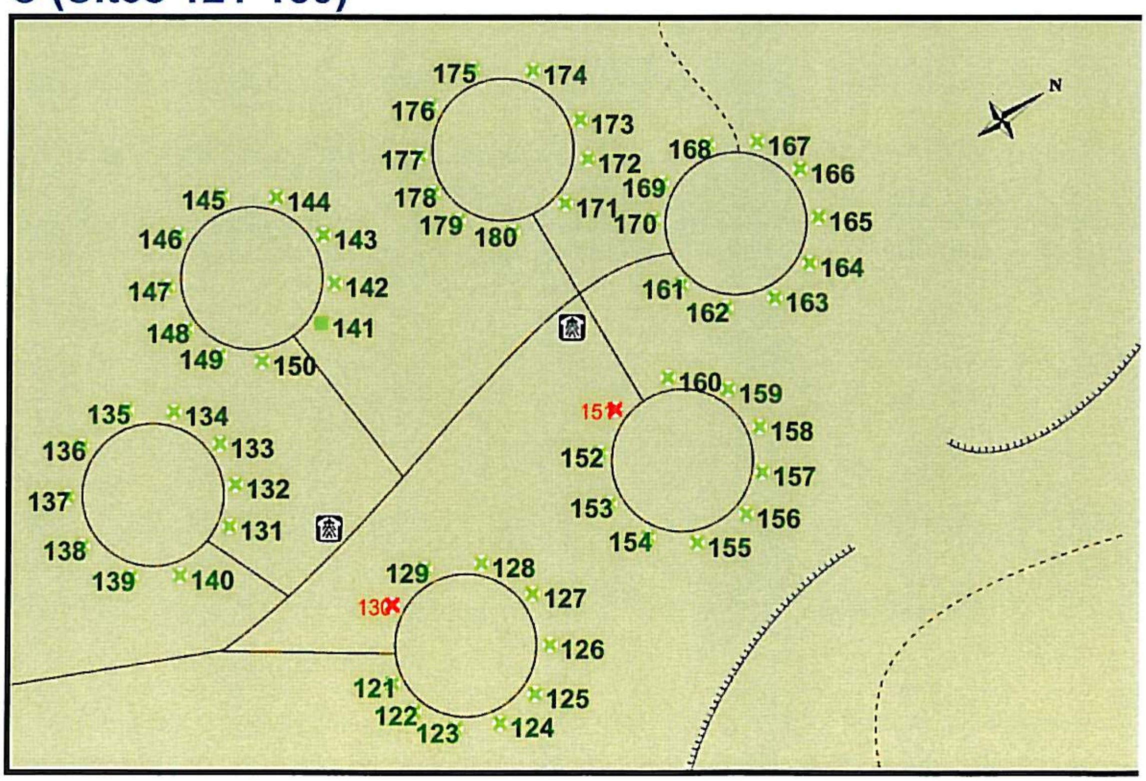
Map Navigation:

BACK TO: Cape Disappointment State Park
BACK TO: Washington State Overview Map

Map Options:

Click Here For Map Legend

C (Sites 121-180)



Washington State Parks
In cooperation with TACOMA POWER PARKS
TACOMA PUBLIC UTILITIES

Cape Disappointment Map Browser

Map Information:

This map will show availability information once you have entered dates for your trip.
You can enter dates once you have selected a campsite, or you can select New Reservation in the left-hand menu to enter dates.

Site Availability Legend:

Site numbers in GREEN are reservable.

Site numbers in RED are NOT available.

Site numbers in GREY are Non-Reservable.

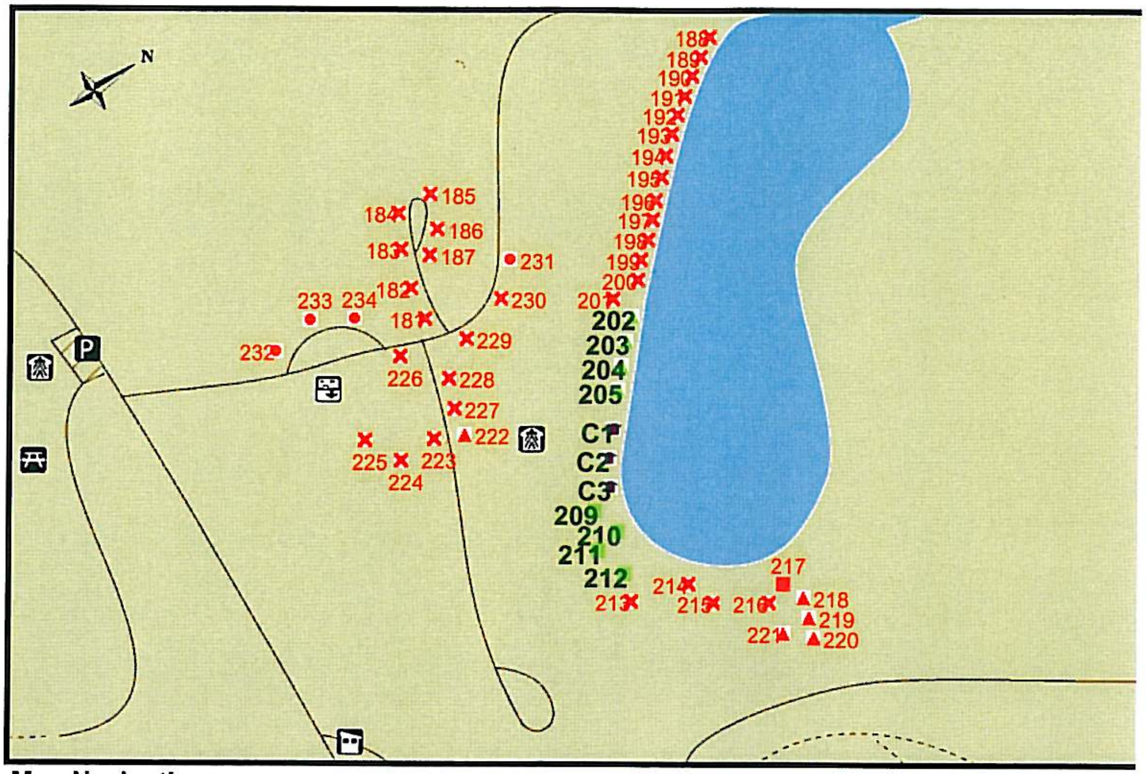
Site Icons Legend:

Sites shape indicates the maximum equipment the site can accommodate.	**Tents**	**Trailers**		
	Tents	**<18ft**	**<32ft**	**>32ft**
Booked/Closed Sites	●	▲	■	✖
Non-Reservable Sites	●	▲	■	✖
Available Sites				
Primitive Campsites	●	▲	■	✖
Standard Campsites	●	▲	■	✖
Roofed Accommodations				

Map Navigation:
BACK TO: Cape Disappointment State Park
BACK TO: Washington State Overview Map

Map Options:
Click Here For Map Legend

D (Sites 181-250 and Cabins)



Map Navigation:

BACK TO: Cape Disappointment State Park BACK TO: Washington State Overview Map

Back To Map

Welcome to
Washington State Parks

Cape Disappointment

Park Overview
Cape Disappointment State Park (formerly Fort Canby State Park) is a 1,882-acre camping park on the Long Beach Peninsula, fronted by the Pacific Ocean. The park offers 27 miles of ocean beach, two lighthouses, an interpretive center and ... Visitors enjoy beachcombing and exploring the area's rich natural and cultural history. The nearby coastal towns of Ilwaco and Long Beach feature special events and festivals spring through fall.

Camping Reservations
Reservations information.

Camp Site Maps

Reservations at Washington State Parks

Winter Schedule

Purchase a Natural Investment permit
This permit is required for use of watercraft launches and trailer dumps.

Park Hours
Summer: 6:30 a.m. to 10 p.m.
Winter: 6:30 a.m. to 4 p.m.

The park is open year round for camping and day use.

Camping:
Check-in time, 2:30 p.m.
Check-out time, 1 p.m.
Quiet hours: 10 p.m. to 6:30 a.m.

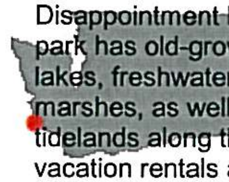
Special Offers
Special offers available from Washington State Parks.

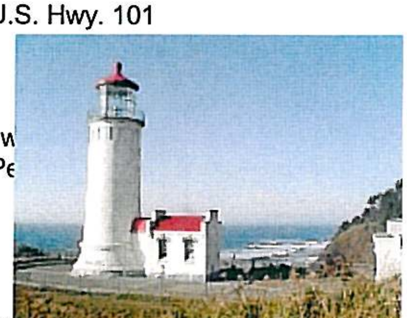
Driving Directions
Located two miles southwest of Ilwaco, Wash.

From Seattle:
Take I-5 south to Olympia, SR 8 west to Montesano. From there, take U.S. Hwy. 101 south to Long Beach Peninsula.

From Portland:
Take I-5 north to Longview, then SR 4 w... 101. Then drive south to Long Beach Pe... signs to Ilwaco and the park.

Popular Park Features
The park offers breathtaking views of the Pacific Ocean, Columbia River, North Head Lighthouse and Cape Disappointment Lighthouse. The park has old-growth forest, lakes, freshwater and saltwater marshes, as well as streams and tidelands along the ocean. Three vacation rentals are available.





Camping information and park fees page 2 of
Cape Disappointment

Interpretive Opportunities

Picnic Facilities
The day-use area has 20 unsheltered picnic tables, available first-come, first-served.

Activities

Trails	Water Activities	Other
• 7 mi. Hiking Trails	• Boating (freshwater) • 1 boat ramp (freshwater) • 135 feet of dock (freshwater) • Fishing (freshwater) • Fishing (saltwater) • Clamming • Crabbing	• 1 Amphitheater • Beachcombing • Bird Watching • Golf • 1 Horseshoe pit • Interpretive Activities • Museum • 3 Softball Fields • 2 Volleyball Fields • Wildlife Viewing

Baseball fields and basketball courts located nearby. A Columbia River fish-cleaning station is available to fishermen.

Park events occur spring through fall:
- Loyalty Days - first weekend in May.
- World's Longest Garage Sale - Memorial Day.
- Garlic Festival - third weekend in June.
- Stunt Kite Competition - fourth weekend in June.
- Fireworks on the beach - 4th of July.
- Sand Sculpture Contest - third weekend in July.
- Rodeo - fourth weekend in July.
- Jazz & Oysters - third weekend in August.
- Kite Festival - third week in August.
- Rod Run - second weekend in September.
- Water Music Festival - fourth weekend in October.

Swimming in the ocean on the Long Beach Peninsula is not recommended. Strong currents, riptides and unexpected high waves pose a hazard to swimmers.

Significant nearby natural areas include Willapa Bay, Leadbetter Point and Beard's Hollow.

Boating Features
One boat ramp and 135 feet of dock are provided on Baker Bay in the Columbia River.

A daily permit is available for watercraft launching and trailer dumping at the park for $5.
Annual permits also may be purchased at State Parks Headquarters in Olympia, at region offices, online, and at

Lewis and Clark Interpretive Center (LCIC), perched on a 200-foot-high cliff, tells the story of Lewis and Clark and their journey from St. Louis to the Pacific Ocean.
LCIC hours: Open year-round from 10 a.m. to 5 p.m. daily.
LCIC admission: $5 per adult, $2.50 children ages 7 to 17, free ages 6 and younger.

North Head Lighthouse is also open to visitors (tours cost $2.50 per adult, free ages 7 to 17). We do not accept any Federal or State passes. Call the park office at (360) 642-3078 for hours and tour information.

The Colbert House Museum is open May 26 through Sept. 30 from 10 a.m. to 4 p.m., Friday through Sunday.

Other interpretive opportunities, such as the Fort Columbia Interpretive Center and the Fort Columbia Commanding Officer's House Museum, also are in the vicinity.

Reservation Parks and Procedures

A complete list of parks including reservation parks and how to make a reservation.

parks when staff is available.

Featured Creatures

Mammals

- Bears
- Chipmunks
- Coyotes
- Deer or Elk
- Rabbits
- Raccoons
- Skunks
- Squirrels
- Weasels

Birds

- Crows or Ravens
- Doves or Pigeons
- Ducks
- Eagles
- Geese
- Grouse
- Gulls
- Hawks
- Herons
- Hummingbirds
- Jays
- Ospreys
- Owls
- Snipes
- Swans
- Woodpeckers
- Wrens

Fish & Sea Life

- Clams
- Crabs
- Mussels
- Sea Birds
- Seals
- Shellfish
- Shrimp
- Squid
- Starfish
- Whales
- Bass
- Cod
- Perch
- Red Snapper
- Salmon
- Steelhead
- Sturgeon
- Trout
- Tuna

Environmental Features

Physical Features

Plant Life

- Cedar
- Douglas Fir
- Hemlock
- Ponderosa Pine
- Spruce
- Alder
- Maple
- Poplar
- Daisy
- Foxglove
- Rhododendron
- Rose
- Berries
- Eel Grass
- Ferns
- Moss or Lichens
- Seaweed
- Thistle
- Poison Oak

Special

History

In 1788, while in search of the Columbia River, English Captain John Meares missed the passage over the river bar and named the nearby headland Cape Disappointment for his failure in finding the river. In 1792, American Captain Robert Gray successfully crossed the river bar and named the river "Columbia" after his ship, the Columbia Rediviva. Only a few years later, in 1805, the Lewis and Clark Expedition arrived at Cape Disappointment.

The Cape Disappointment Lighthouse was constructed in 1856 to warn seamen of the treacherous river bar known by then as "the graveyard of the Pacific." This is the oldest functioning lighthouse on the West Coast.

In 1862, Cape Disappointment was armed with smoothbore cannons to protect the mouth of the Columbia River from enemies. The installation was expanded to become Fort Canby in 1875. The fort was named after General Edward Canby, who was killed in the Modoc Indian War. The fort continued to be improved until the end of World War II. Gun batteries still sit uptop the park.

Go to page 2 for this park

Nature HISTORY Discovery

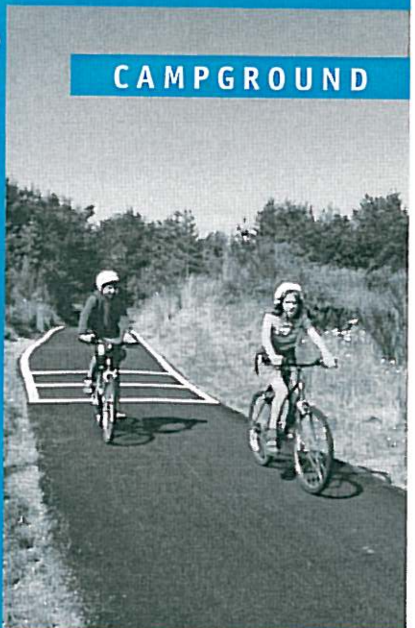
Fort Stevens

Reserve early! Reserve yurts and campsites and group sites two days to nine months in advance through Reservations Northwest at 1-800-452-5687. More details: **www.oregonstateparks.org**

Need to cancel your reservation? Follow this guideline: If your reservation is for today or tomorrow, call 503-861-1671. Otherwise, call Reservations Northwest at 1-800-452-5687.

Park Information:
1-800-551-6949
www.oregonstateparks.org

CAMPGROUND



Fort Stevens State Park

Off US 101, 10 miles W of Astoria
100 Peter Iredale Road, Hammond, OR 97121
503-861-1671

Latitude: 46.18422 N
Longitude: -123.95682 W

One of the nation's largest public campgrounds lies next to the site of a military installation once used to guard the mouth of the Columbia River.

Year-Round Camping

- 174 full hookup sites (sewer, electricity, water; 36 pull-through)
- 302 electrical sites with water (11 pull-through)
- 19 tent sites with water nearby
- 15 yurts
- Paved parking, picnic table, fire ring at all sites
- Hiker/biker sites
- Flush toilets and hot showers
- RV dump station (300 feet east of ranger station)

Universal Access

4 campsites (North Loop: 77, 78, 89, 90) and all but 5 yurts are accessible to campers with disabilities.

Recreational Amenities

- Day-use area; access to miles of broad, sandy beaches
- 2 covered picnic shelters (reservable)
- Freshwater lakes
- 9 miles of bike paths
- 5 miles of hiking trails
- Northern trailhead for the Oregon Coast Trail
- Wildlife viewing platforms

Camping Rates

	*Oct 1 – Apr 30	May 1 – Sep 30
Full hookup/elec.	$18	$22
Tent	$13	$18
Yurts	$30	$30
Hiker/Biker	$4	$4
Extra Vehicle	$5	$5

(rates per night, subject to change)

*Discovery Season

From October 1–April 30, camping in an Oregon state park costs less. You can save $4-5 per night off summer rates for full hookup, electrical and tent sites.

Driving on the Beach

Motor vehicles on the beach are prohibited north of the Peter Iredale beach access to the South Jetty from noon to midnight, May 1–Sept. 15. Motor vehicles are allowed year-round between the Peter Iredale access south to the Gearhart beach ramp. Maximum speed is 25 m.p.h.

Ships, Waves and Wildlife

Watch waves breaking and big ships crossing the famous Columbia River bar from the observation platform near the South Jetty on Clatsop Spit. The jetty was built in the late 1800s by the U.S. Army Corps of Engineers. A wildlife viewing platform on Clatsop Spit overlooking Trestle Bay and another near Swash Lake are excellent spots for birdwatching.

Summertime programs include Junior Ranger activities, evening campfire presentations and guided bicycle tours.

Explore the Historic Military Site

Abandoned fort: The Fort Stevens Military Reservation guarded the mouth of the Columbia River from the Civil War through World War II. Today you can explore the abandoned gun batteries and climb to the commander's station for a view of the Columbia River and South Jetty. Ask for a brochure describing the self-guided walking tour.

Military museum: The Military Museum contains artifacts and interpretive displays depicting the history of the fort. Hours: 10 a.m.– 6 p.m. daily, June–September; 10 a.m.– 4 p.m. October–May.

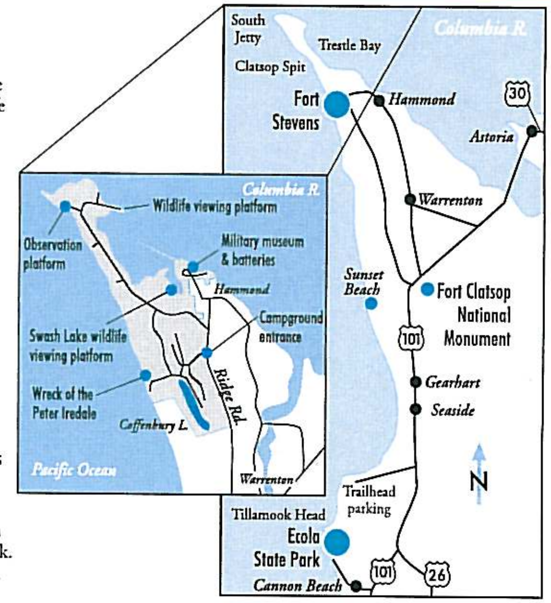
Guided tours: Summer visitors may enjoy guided tours of the unique underground Battery Mishler, and a tour in the back of a restored 1954 "deuce-and-a-half" army truck. Group tours may be arranged by calling the Historic Area Military Museum at (503) 861-2000, 10 a.m.– 4 p.m., Monday–Friday. Allow two weeks' notice. Tours, special events and museum services are courtesy of the Friends of Old Fort Stevens, a private, nonprofit group.

Shipwreck remains: The rusting wreck of the "Peter Iredale" lies near the beach parking area. The English sailing ship ran aground during a storm in 1906.

More History Survives Nearby

You can ride a bus from Fort Stevens to the Fort Clatsop unit of Lewis and Clark National and State Historical Park. The Corps of Discovery spent the winter of 1805-06 there. Ask for a bus schedule and information at our ranger station.

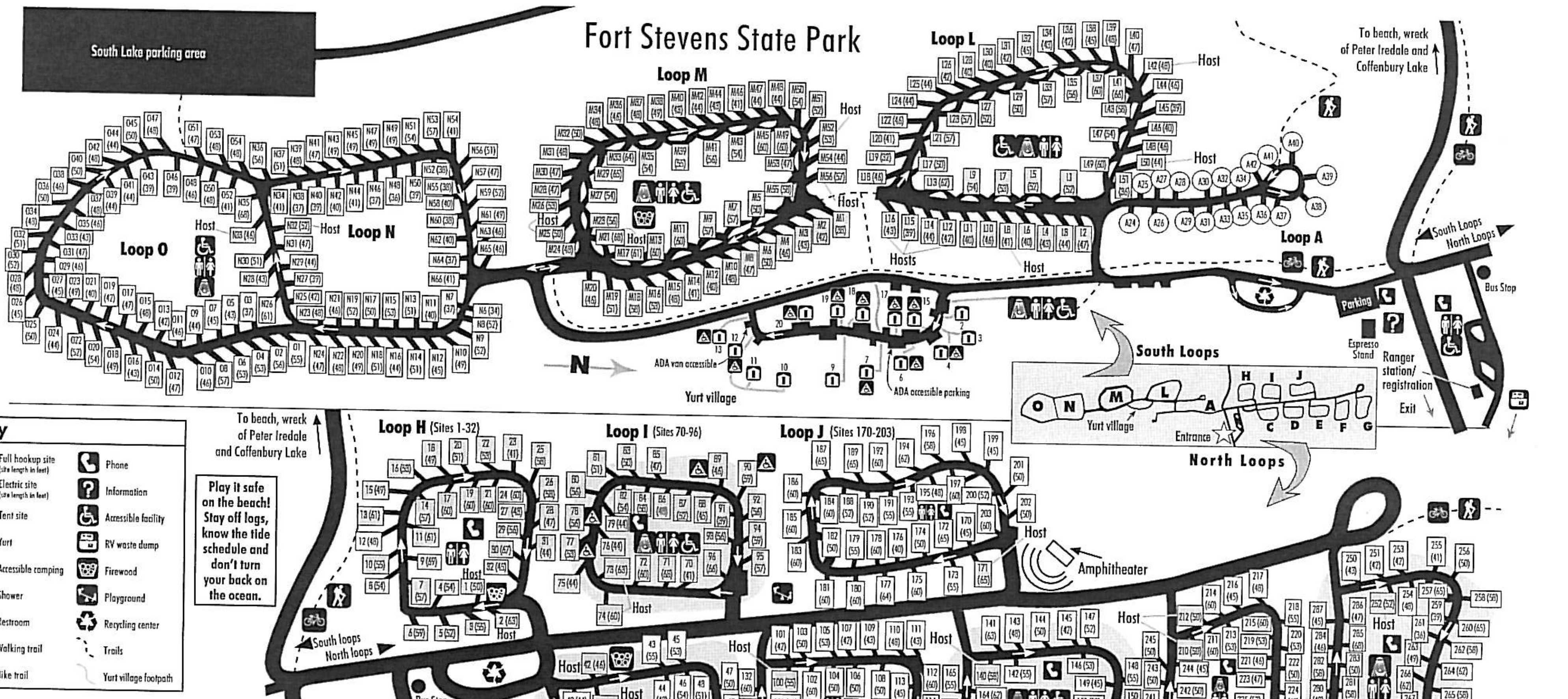
Astoria, the first permanent European-American settlement west of the Mississippi River, features Fort Astoria, a reconstructed fur-trading outpost, several museums, including the Columbia River Maritime Museum, and historic homes.



Visiting for the Day?

Fort Stevens State Park requires a day-use pass all year in the Coffenbury Lake Day-use Area and the Historic Military Site. You'll need to display either a daily permit, 12- or 24-month pass, Oregon Pacific Coast Passport or your camping receipt on the driver side of your dashboard. Your camping receipt is equal to a daily permit for those days registered. You may purchase a $3 daily permit from the yellow vending machines. 12-month passes ($25) and 24-month passes ($40) are sold by merchants near the park, G.I. Joe's stores throughout Oregon and at major state park offices.

Coffenbury Lake has two swimming areas, a picnic area, restrooms, and a boat ramp (10 m.p.h. boating speed limit).



Please help make camping here a safe and enjoyable experience by following these and other park rules:

- Campground quiet hours are between 10 p.m. and 7 a.m. A curfew for visitors under age 18 is in effect 12-5 a.m.
- Park vehicles and other equipment on paved areas only.
- Bicycles are permitted on park roads, but ride them with the traffic flow. Riders under age 16 must wear helmets.
- Keep pets on a leash no longer than six feet. Pets must be under control at all times when not confined in a vehicle. Wastes must be properly removed.

Check-in time: 4 p.m.
Check-out time: 1 p.m.

This publication is available in alternative formats upon request. Write to Oregon Parks and Recreation Department, 725 Summer St. NE, Suite C, Salem, OR 97301. You may also call 503-986-0707 or 1-800-735-2900 (Oregon Relay for the hearing impaired).

63400-8121 (3/07)

FORT STEVENS STATE PARK

RESERVE ONLINE

Go to My Parks

Fort Stevens was the primary military defense installation in the three fort Harbor Defense System at the mouth of the Columbia River (Forts Canby and Columbia in Washington were the other two). The fort served for 84 years, beginning with the Civil War and closing at the end of World War II. Today, Fort Stevens has grown into a 3,700 acre park offering exploration of history, nature, and recreational opportunities.

And you can help fund historic programs and restoration at the park! The Friends of Old Fort Stevens will run Wood on Wheels this summer, selling and delivering firewood right to your site. Check it out when you arrive!

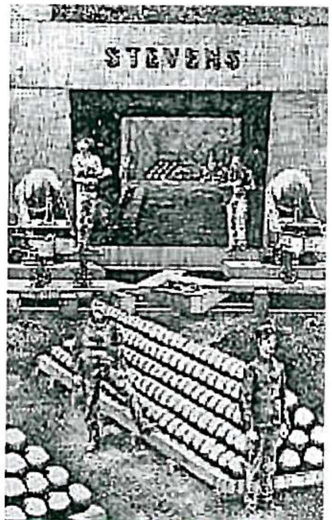
Camping, beachcombing, freshwater lake swimming, trails, wildlife viewing, an historic shipwreck and an historic military area make Fort Stevens a uniquely diversified park. A network of nine miles of bicycle trails and six miles of hiking trails allow you to explore the park through spruce and hemlock forests, wetlands, dunes, and shore pine.

Coffenbury Lake has two swimming areas, a picnic area, restrooms, and a boat ramp (10 mph boating speed limit). Two other smaller lakes offer boat ramps for fishing and canoeing.

Throughout the year, you can browse through displays dating back to the Civil War at the museum, visit the only enclosed Civil War earthworks site on the west coast, and explore the gun batteries.

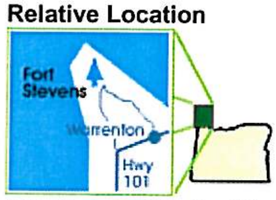
During the summer, watch the blacksmiths work, tour a rare 90-year old underground gun battery that served as a World War II command center, and take a truck tour of the fortifications spanning the Spanish-American War and World War II (tour available at a nominal charge).

Fort Stevens Trail Guide and Historic Military Site brochure



SEE MORE PHOTOS

Relative Location



Off US 101, 10 miles W of Astoria

Get directions to this park:

Your full starting address
OR
town and state
OR
zip code

Get Directions

Google™ Maps opens in a new window

These driving directions are provided as a general guide only. No representation is made or warranty given as to their content, road conditions or route usability or expeditiousness. User assumes all risk of use. For your safety, please consult

Graveyard of the Pacific (1.1mb pdf)

Fort Stevens Mushrooms

View brochure (1.7mb; full park brochure and map; requires Acrobat)

Park map (813k; just the campground map; requires Acrobat)

Vital stats
$3 daily day-use fee or buy a $25 annual permit for access to all state park day-use areas.

174 full hookup, 302 electrical, 19 tent (maximum site 50 feet); 15 yurts; hiker/biker camping by request. For information only, (503) 861-1671 or (800) 551-6949. To make reservations, call (800) 452-5687.

Discovery Season

During Discovery Season (October 1 to April 30), Fort Stevens has a limited amount of campsites available through the reservation system. RNW may not have all campsites available for reservations, but Fort Stevens will have campsites available on a first-come, first-served or drop-in basis. Additional loops will be opened, as necessary, to accommodate arriving campers.

Park rates (subject to change)

October 1 to April 30 (Discovery Season)	*May 1 to September 30*
Full rate: $18	Full rate: $22
Electrical hookup: $18	Electrical hookup: $22
Tent site: $13	Tent site: $18
Hiker/Biker: $4	Hiker/Biker: $4
Yurt: $30	Yurt: $30
Extra vehicle: $5	Extra vehicle: $5
Daily day use: $3	Daily day use: $3
Yearly day use: $25	Yearly day use: $25

Services

•Camping •Accessible •Tent

the official Oregon highway map and check road conditions at Tripcheck before leaving on your trip.

Lat.: 46.18422 N
Long.: -123.95682 W

	camping	
•Electric	•Full hookup	•Yurts, cabins, tepees
•Showers	•Dump station	•Reservations
•Hiker/Biker	•Playgrounds	•Group shelter
•Reservable group shelter	•Picnicking	•Wildlife watching
•Bird watching	•Marine mammal watching	•Terrestrial mammal watching
•Native plant	•Boating	•Boat ramp
•Fishing	•Windsurfing	•Swimming
•Beach access	•Horse trail	•Walking trail
•Hiking trail	•Bicycle trail	•Special events
•Nature programs	•Historic programs	•Athletics
•Interpretive events	•Forest	•Wetland
•Waterways	•Lake	•Dunes
•Beach	•Historic resources	•Historic buildings
•Historic sites	•Historic trails	•Museums
•Living history	•Historic signs	•Historic displays
•Interpretation	•Interpretive tours	•Evening programs
•Interpretive signs	•Interpretive displays	•Nature/Visitor center
•Interpretive store	•ADA restroom	•Year-round
•Restrooms		

Related Links
City of Astoria
Weather
City of Warrenton
Friends of Old Fort Stevens
Lewis & Clark Bicentennial
Cannon Beach
Oregon Coast Visitors Association
Ft. Clatsop
Fort to Sea Trail
Seaside Visitors Bureau

Visitor Tales
Read them here.

Add to Saved Parks
View Saved Parks ?

Estimated average monthly boat count by fishery in the Columbia River downstream of Bradwood area.

		Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Total
Columbia River	Sport Sturgeon[acd]		25	50	150	3,090	8,320	3,080	362	32				15,109
	Sport Salmon (Buoy 10)[ace]								14,980	6,914				21,894
	Spring/Summer Chinook & Sthd[a]	0	50	3,300	7,300	425	430	400	450	400	35			12,790
	Sport Bottomfish[af]		60	150	90					60				360
	Sport Crabbing[ai]	500	30	15	10	50	150	200	450	450	850	650	700	4,055
	Commercial Gillnet[ag]	37	70	206	0	456	187	308	939	446	665	0	20	3,334
	Commercial Crabbing[ah]	185	90										400	675
Transit via Columbia River	Ocean Sport Salmon[bc]					8	40	744	2,638	569				3,999
	Ocean Sport Halibut/Bottomfish[bc]					53	35	26	10	4				128
	Ocean Sport Tuna[bc]					0	4	9	15	12				40
	Ocean Crab [k]													0
	Ocean Comm. Crab[bl]	862	769	447	364	242	127	61	32				464	3,368
	Ocean Comm. Shrimp[bl]				43	86	71	64	64	66	45			439
	Ocean Comm. Bottomfish[bl]*	54	82	66	102	146	192	180	175	136	110	54	55	1,352
	Ocean Comm. Salmon[bl]			6	4	105	41	26	42	25	7			256
	Ocean Comm. Sardine[bl]						68	436	604	414	110	6	2	1,640
	Ocean Comm. Tuna[bl]						4	78	124	84	37			327
	Ocean Comm. Whiting[bl]						128	216	50	2				
	Total	**1,638**	**1,176**	**4,240**	**8,063**	**4,661**	**9,797**	**5,828**	**20,935**	**9,614**	**1,859**	**710**	**1,641**	**69,766**

Peak periods

[a] Combined OR/WA data

[b] Oregon only data. All combination trips are assigned to salmon effort (salmon+bottomfish, salmon+tuna, and salmon+halibut), May through Sept effort only

[c] 2002-06 effort based on exit counts of boats that are then assigned to trip type based on interviews on a portion of the boats at the end of their trips.

[d] Season open Jan 1-Apr 30 and mid-May thru harvest quota (around Jul 4).

[e] Season open Aug 1 thru Dec 31. Main part of season is mid-Aug thru early-Sep.

[f] Educated guess

[g] 2006 data

[h] Based on commercial crabber estimate

[i] 2004-06 creel data

[j] 2002-2006 average of Troll Salmon Deliveries (should roughly equate to vessel bar crossings)

[k] Ocean recreational crabbing is usually part of another targeted fishing trip, and would be included with other listed trip types.

[l] 2002-2006 average of fish ticket deliveries

Red text indicates effort doubled to represent both seaward and return trip

Oregon LNG Terminal and Pipeline Project

Wind/Current Data Analysis

Alignment Alternatives Study

Prepared for:
LNG Development Company, LLC
and
Oregon Pipeline Company

Prepared by:
CH2M HILL
1100 – 112th Avenue, Suite 400
Bellevue, WA 98004-4505

CH2MHILL

Table of Contents

Tables

Figures

Appendices

1.0 Introduction and Purpose

Oregon LNG proposes to construct and operate an onshore LNG receiving terminal and associated facilities (Terminal) on the East Skipanon Peninsula (ESP) near the confluence of the Skipanon and Columbia Rivers at Warrenton, Clatsop County, Oregon (Figure 1.1-1). The Project includes construction of a slip and berth for offloading LNG carriers (LNGCs), facilities to receive and regasify LNG for transport to the United States (U.S.) natural gas transmission grid, and approximately 117 miles of 36-inch-outside-diameter (OD) natural gas pipeline interconnecting with the interstate natural gas transmission system of Williams Northwest Pipeline (Williams) at the Molalla Gate Station. The Project will be constructed and operated in compliance with applicable Federal, state, and local regulations.

During the conceptual development phase of the project, two possible marine terminal configurations were developed and limited site data including wind and current velocity and direction were collected. The purposes of this study are as follows:

- Collate collected wind data, correlate with long term data available at the adjacent Astoria Airport, and perform extremal analysis to extract design wind speed and direction.
- Inspect collected current data and develop design currents and direction based on engineering judgment. It should be noted the limited nature of the current data is not conducive to the same level of analysis that is performed for the wind data.
- Review and analyze the previously developed marine terminal configurations and propose a preferred alternative location and orientation.

1.1 Wind Data Analysis Overview

Wind speed and direction date was collected near the project site at Green Channel Marker No. 3 on the east bank of the Skipanon River Channel for a one-year period from February, 2005 through January, 2006. A long term data series taken over a 30-year period at the nearby Astoria Airport was obtained from the Oregon State Climatologist's Office and used for verification of and correlation with the site data. As expected, a very high correlation was found between the two datasets, in excess of 90%. It has therefore been determined that the transformed Astoria Airport data is sufficient for use for the LNG marine facility design.

An extremal analysis performed as part of this study yielded the design wind speeds for various measurement intervals (hourly, 10 min, 3 sec) and for various return periods (2 years to 100 years) to be used for facility design. Average hourly wind speeds for various return periods are shown in Table 1.

TABLE 1
Average Hourly Wind Speeds

Return Period, years	Wind Speed, mph	Probability of Exceedance, %
2	38.8	22.8%
5	42.7	11.7%
10	45.2	6.2%
15	46.7	4.2%
20	47.7	3.2%
25	48.5	2.6%
30	49.1	2.2%
40	50.1	1.6%
50	50.8	1.3%
75	52.2	0.9%
100	53.2	0.7%

1.2 Current Data Analysis Overview

Current speed and direction data was collected near the project site at the USCG Front Range Board structure at Tansy Point on the south side of the Columbia River Ship Channel. Thirteen months of data was collected during a 28 month period from April, 2002 through July, 2004 mostly during the spring and summer months. No data is available for the months November through March. As expected, current directions are very consistent at azimuths of 305-307. The maximum measured (ebb) current during the period was 3.17 knots.

1.3 Alignment Alternatives Overview

A conceptual LNG berth arrangement study was performed by Moffatt & Nichol dated December 3, 2004, entitled *Columbia River LNG Receiving Terminal – Marine Facilities Conceptual Arrangements* as part of the early project development. In this study, two alternative arrangements were proposed, Alternative 1 with the berthing line generally parallel to the Columbia River current, and Alternative 2 with the berthing line generally perpendicular to the current. Alternative 1 was recommended as the preferred alternative to carry forward into the next phase of project development.

We agree with the general recommendations from the above mentioned report. However, subsequent project development and interaction with various regulatory agencies (principally the US Coast Guard (USCG), additional concerns have surfaced regarding waterway safety since the facility is sited near the turn in the Columbia River shipping channel at Tansy Point. We have therefore included a third

Alternative 1A that sites the berthing line nearer to the shore facilities and thus, further from the shipping channel.

2.0 Wind Data Analysis

The first step in the analysis is to correlate one year of wind speed and wind direction data from the weather station located on Green Channel Marker 3 on the East bank of the Skipanon Waterway to the wind collected from the Astoria airport for the same time span; the data analyzed are the one hour averaged wind speeds and directions for each day of record. CH2M HILL collected the data from the Skipanon Weather Station, and the Oregon State Climatologist, Mr. George Taylor, provided the data from the Astoria Airport.

The correlations were then applied to over 30 years of wind data at the Astoria Airport, again obtained from the Oregon State Climatologist's Office. This data was collected and presented as the maximum hourly wind speed for each hour of each day on record.

The data is analyzed using two software packages: Correlations are calculated with the software package "WindRose", and projections of maximum wind speeds and return periods are calculated with the software package "Windographer". The data input for WindRose consists of the wind data from two sites; the reference site (Astoria Airport) and the target site (Skipanon Weather Station).

2.1 Correlation Analysis

WindRose performs complete statistical analysis of time-series wind speed and direction data, then correlates data from two sites and provides predicted time-series for the target site, based on the detailed correlation (per wind speed and direction ranges) of the concurrent data of the two sites (MCP method). The results of the analysis are stored graphically and numerically into spreadsheets, which can be further manipulated as ordinary Excel files.

The wind data from the Astoria Airport was formatted as date, time, wind speed, direction and gusts per hour for each day of record. The time step chosen for the analysis was one hour, since the vast majority of the data is presented in this format. The data was filtered to remove any records not based on a one hour time step.

The wind data from the Skipanon Station was formatted as date, time, wind speed, direction, and gusts, The parameters were recorded as the true wind speeds and directions each four to five minutes. As in the Astoria Airport data, the entries were filtered to remove any records not based on the appropriate time step.

Wind speeds are organized into discreet bins as follows: 0 to 5 m/s, 5 to 10 m/s, 10 to 15 m/s, and so on. The software recorded the number of observations per wind speed bin per direction, and the number of observations of each direction. The directional data was sorted into eight discreet bins as follows: NE, E, SE, S, SW, W, NW, and N.

The detailed results of the correlation for 12 months of wind data is presented in Appendix C of this report for each month of analysis: February 2005 through January of 2006. In general, the wind speeds at Skipanon are higher than those measured at the Astoria Airport; the directions correlate quite well with one exception in the North direction. The weighted average results for the correlation of wind and direction are given in Tables 2 and 3 below:

TABLE 2
Weighted Average Correlation Results
Speed and Direction

Wind Direction	Speed Bin (m/s)	Speed Bin (mph)	Avg. Hourly Wind Speed Astoria (mph)	Avg. Hourly Wind Speed Skipanon (mph)	Avg. Hourly Direction Astoria (deg)	Avg. Hourly Direction Skipanon (deg)
Northeast	0-5	0-11	7	13	49	59
	5-10	11-22	14	16	50	52
	10-15	22-34	24	24	57	51
East	0-5	0-11	6	12	92	87
	5-10	11-22	14	20	89	73
	10-15	22-34	-	-	-	-
Southeast	0-5	0-11	5	8	134	133
	5-10	11-22	13	16	133	122
	10-15	22-34	-	-	-	-
South	0-5	0-11	7	9	180	185
	5-10	11-22	15	18	187	186
	10-15	22-34	25	28	185	190
Southwest	0-5	0-11	7	7	226	226
	5-10	11-22	15	15	223	213
	10-15	22-34	-	-	-	-
West	0-5	0-11	7	10	269	277
	5-10	11-22	14	16	270	271
	10-15	22-34	25	25	260	267
Northwest	0-5	0-11	8	11	315	315
	5-10	11-22	16	18	311	311
	10-15	22-34	23	24	315	309
North	0-5	0-11	1	7	359	188
	5-10	11-22	13	12	353	357
	10-15	22-34	-	-	-	-

TABLE 3
Weighted Average Correlation Results
All Directions

Speed Bin (m/s)	Speed Bin (mph)	Average Wind Speed Astoria (mph)	Average Wind Speed Skipanon (mph)	Average Direction Astoria	Average Direction Skipanon
0-5	0-11	6	10	203	184
5-10	11-22	14	17	202	194
10-15	22-34	24	25	210	208

The correlated data were then applied to the average hourly wind speeds obtained from over 30 years of data from the Astoria Airport. The data were analyzed with the "Windographer" software package, a wind data analysis program that reads data from almost any data logger, produces graphs and wind roses, and does advanced statistical processing.

2.2 Extremal Analysis

Windographer's Extreme Wind Analysis module is used to calculate the best-fit Gumbel distribution and predict the maximum wind speed expected within a 2 to 100-year return period. The results of this analysis are given in Table 4 below:

TABLE 4
Maximum Wind Speeds
Various Durations and Return Periods

Return Period, years	Hourly Average		10 Minute Average		3 Second Gust
	Wind Speed, mph	Probability of Exceedance, %	Wind Speed, mph	Probability of Exceedance, %	Wind Speed, mph
2	39	22.8%	42	12.7%	59
5	43	11.7%	47	4.4%	65
10	45	6.2%	49	2.0%	69
15	47	4.2%	51	1.3%	71
20	48	3.2%	52	0.9%	73
25	48	2.6%	53	0.7%	74
30	49	2.2%	54	0.6%	75
40	50	1.6%	55	0.4%	76
50	51	1.3%	55	0.3%	78
75	52	0.9%	57	0.2%	80
100	53	0.7%	58	0.2%	81

The direction of the maximum wind speeds falls primarily between 170 and 220 degrees (Southeast to Southwest).

3.0 Current Data Analysis

Data for River currents are collected from an ADP (Doppler) instrument located at the USCG Front Range Board structure at Tansy Point on the south side of the Columbia River Ship Channel. This is the only available data set near the project site. 13 months of partially complete data are available between 2002 and 2004. This data has been analyzed to determine the maximum current magnitude and associated direction.

The data were presented by the true East and true North velocities in cm/s every five minutes, from depths of -38 feet to the surface. Much of the surface data was unusable due to surface interference and reflection. The true East and true North velocities are combined as vector to determine speed and direction

The data has been separated into discreet bins of 0-10 feet in depth, 10-20 feet, 20-30 feet, and 30-40 feet in order to develop a current profile. The limitations of duration, missing data in the set, and lack of data during the winter months precluded any meaningful statistical analysis. Therefore, maximum current speed extracted from the dataset is shown in Table 5:

TABLE 5
Maximum Current Speeds at Tansy Point
Knots

Month	Depth				
	0-10'	10-20'	20-30'	30-40'	Average
Apr-02	-	2.83	2.56	2.24	2.55
May-02	3.15	3.14	2.76	2.23	2.82
Jun-02	2.38	2.65	2.57	2.00	2.40
Jul-02	-	2.81	2.48	2.13	2.48
Apr-03	2.72	2.57	2.34	1.96	2.40
May-03	2.75	2.55	1.91	1.69	2.22
Jun-03	-	2.80	2.43	1.97	2.40
Jul-03	-	2.83	2.50	2.10	2.48
Sep-03	-	2.61	2.26	1.91	2.26
Oct-03	-	2.68	2.40	1.97	2.35
May-04	3.17	2.92	2.48	2.07	2.66
Jun-04	2.95	2.89	2.57	2.21	2.65
Jul-04	-	2.85	2.51	2.05	2.47
Average	2.85	2.78	2.44	2.04	2.47

All velocities represent outgoing (ebb) currents. The directions are very consistent, varying between 305 and 307 degrees. It is seen that the maximum currents in this limited set generally fall within the Spring Season (April-June).

4.0 Alignment Alternative Study

A conceptual LNG berth arrangement study was performed by Moffatt & Nichol dated December 3, 2004, entitled *Columbia River LNG Receiving Terminal – Marine Facilities Conceptual Arrangements* as part of the early project development. In this study, two alternative arrangements were proposed, Alternative 1 with the berthing line generally parallel to the Columbia River current, and Alternative 2 with the berthing line generally perpendicular to the current. Alternative 1 was recommended as the preferred alternative to carry forward into the next phase of project development.

We agree with the general recommendations from the above mentioned report. However, subsequent project development and interaction with various regulatory agencies (principally the US Coast Guard (USCG), additional concerns have surfaced regarding waterway safety since the facility is sited near the Tansy Point Turn in the Columbia River shipping channel. We have therefore included a third Alternative 1A that sites the berthing line nearer to the shore facilities and thus, further from the shipping channel.

4.1 Alternatives Description

4.1.1 Alternative 1

Alternative 1 locates the berth at approximately the 20 ft bathymetry contour, thus maintaining a balance between the dredging volume required and distance from the Columbia River shipping channel.

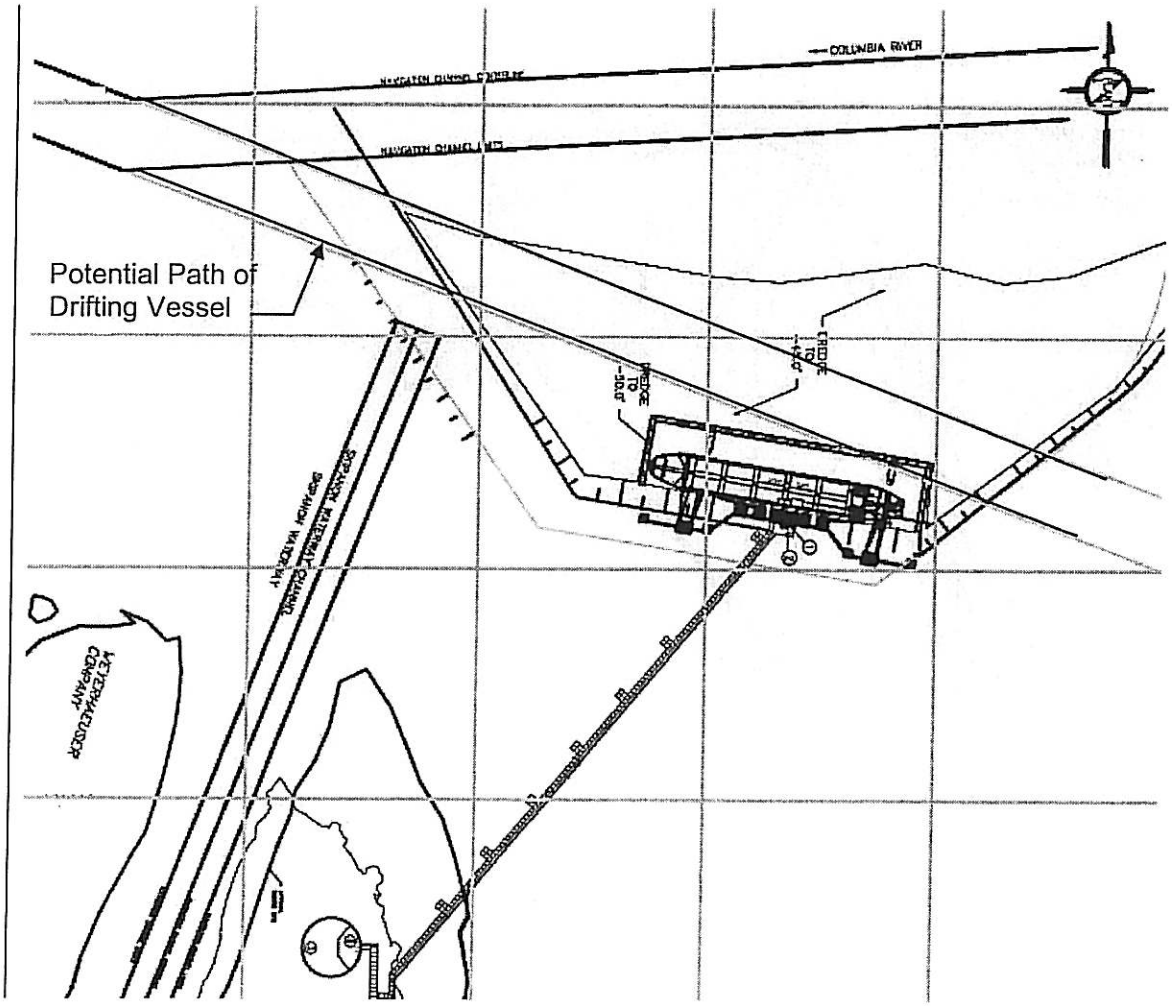


Figure 1: Alternative 1

4.1.2 Alternative 1A

Alternative 1A is similar to Alternative 1 except the berthing line is located closer to shore to minimize ship impact risks and provide a shorter trestle, at the expense of additional dredging.

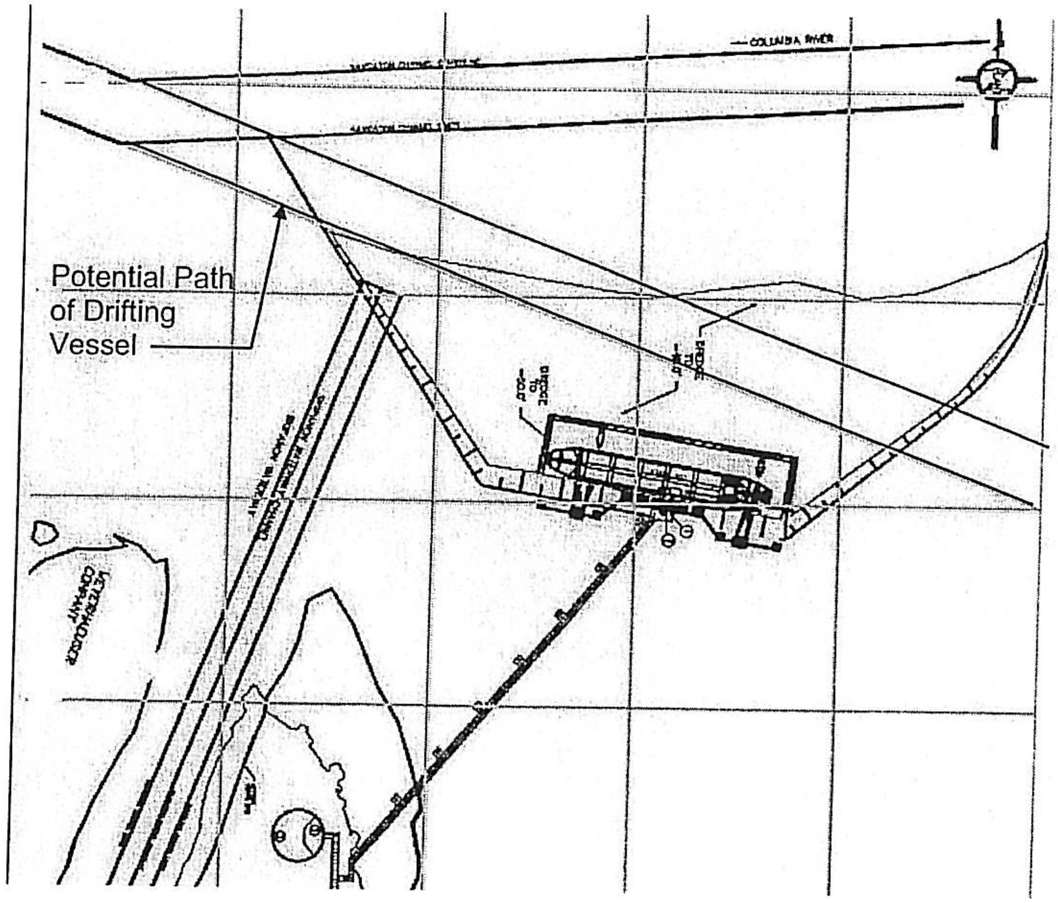


Figure 2: Alternative 1A

4.1.3 Alternative 2

Alternative 2 avoids the vessel collision issue entirely by insuring a physical barrier between a drifting vessel and the berth by orienting the berth in a primarily N-S direction. Dredging volume is between Alternatives 1 and 1A. However, the difficulty in berthing an LNGC perpendicular to currents means vessels will likely only be able to berth (and possibly depart) during periods of slack tide (~0 current), thus limiting berth availability significantly

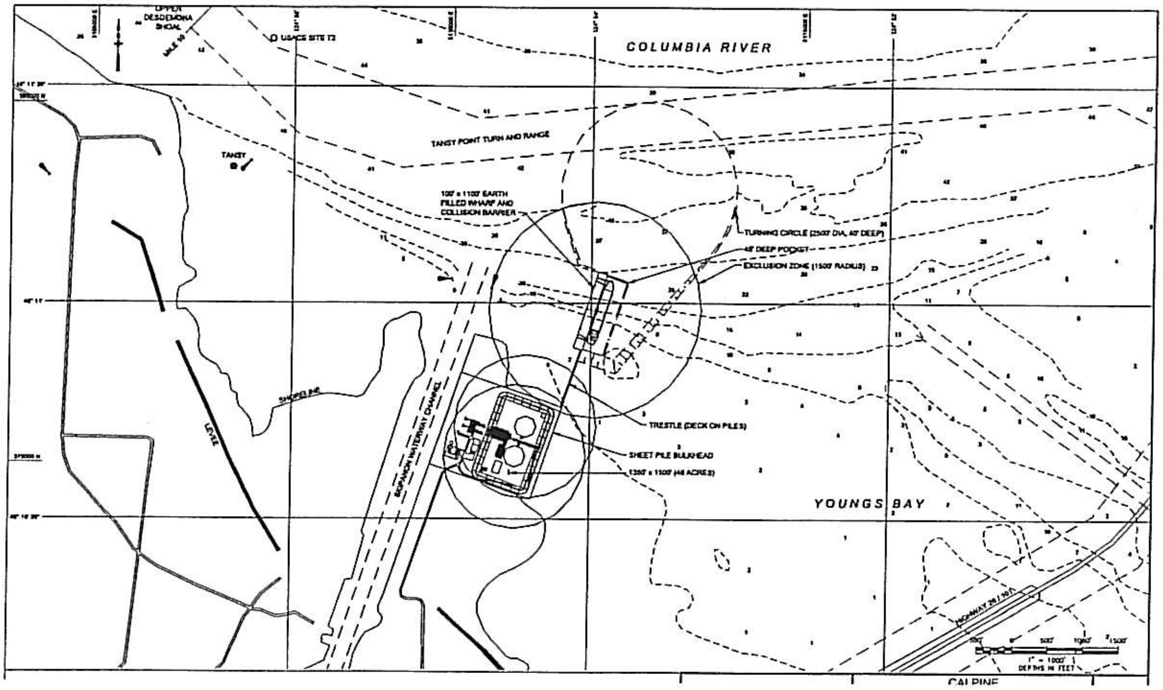


Figure 3: Alternative 2

4.2 Alignment Considerations

4.2.1 Waterway Safety

Waterway safety has become one of the most important elements in the selection of the marine facilities alignments. The fact that the terminal is located near the Tansy Point Turn increases the possibility that a vessel traveling up the waterway that loses steerage could collide with the berth. Alternative 1 is the most vulnerable alignment for such a collision since the facility lies close to a projection of the tangent section preceding the turn. Our view is the vessel collision risk represents a fatal flaw to Alternative 1. Alternative 1A mitigates this potential hazard by moving the facility further away, greatly reducing the collision probability. Alternative 2 completely eliminates the hazard by insuring a drifting vessel will run aground prior to reaching the terminal.

4.2.2 Design

Design of Alternatives 1 and 1A are virtually identical. Both are a traditional T-Head pier with a production platform and independent dolphins. The only differences in design are the amount of

dredging and the length of the trestle. The cost of Alternative 1A will likely be marginally more since the reduction in trestle length will not be comparable to the amount of dredging required.

Alternative 2 is a simpler design, where most of the structures are on land and the amount of dredging is reduced. The design will also be less costly since both the structural work and dredging will be reduced.

4.2.3 Winds and Currents

Winds are currents are at odds at this site. Prevailing strong winds are in the North/South direction while currents are exclusively in the East-West direction. Alternatives 1 and 1A place the vessel broadside to the prevailing winds while allowing the vessel to berth in all but the most severe current regimes.

Alternative 2 minimizes the wind forces on the vessel, however, has the significant drawback of allowing the vessel to berth only at slack tides (close to zero current). This limitation will be severe during the high spring river flows, and will limit berthing/unberthing schedules to four discreet times per day during the rest of the year. Our view is this limitation represents a fatal flaw to Alternative 2 since berth availability is critical to maintaining available feed stock.

4.2.4 Construction

Alternatives 1 and 1A most likely be constructed using primarily marine equipment, which is the conventional way of constructing piers. Alternative 2 will be constructed primarily on land, with only the dredging construction occurring from the water. As mentioned above, the land based construction of Alternative 2 will provide a cost benefit.

4.2.5 Dredging

Dredging for Alternatives 1 and 1A will occur from the water, using either cutter head or clamshell equipment. Altèrnative 1 has a cost benefit over Alternative 1A due to the reduced dredging quantity (800,000 cy v. 1.300,000 cy).

Alternative 2 provides an opportunity to perform some dredging from land, and also has the benefit of the least dredging of all the alternatives.

4.2.6 Maintenance

Each alternative will require maintenance dredging to keep the berth available for the relatively deep draft LNGC's. Alternatives 1 and 2 are expected to require a similar volume of maintenance dredging, while Alternative 1A will require a marginally higher quantity due to it's presence closer to land.

The structures themselves will also require periodic maintenance such as painting and maintaining the cathodic protection system. Alternatives 1 and 1A have a considerable number of steel piles that will need to be aggressively protected from corrosion. A passive cathodic protection system should perform adequately.

Alternative 2 will required a relatively large quantity of steel sheet piling, which can be quite difficult to protect when exposed to brackish water. Providing a sacrificial metal thickness in combination with durable coatings is the usual means of protection. Cathodic protection can also be used, but traditionally has had limited success.

4.2.7 Environmental Issues

Dredging is the primary environmental issue associated with dock construction. Each alternative will require dredging and disposal issues that will need to be addressed. Alternative 2 requires less dredging, with Alternative 1 in the middle, and Alternative 1A requires the most.

Over-water shadow will be the other significant environmental issue for the dock structures. Alternatives 1 and 1A will each provide a similar quantity of shadow over water, which will be partially mitigated by using open deck grating where possible. Alternative 2 avoids this issue by placing the dock structures on land.

4.3 Recommended Alternative

We recommend Alternative 1A as the preferred alternative. The strengths of Alternatives 1 and 2 are overshadowed by their fatal flaws: Alternative 1 lacks appropriate waterway safety, and Alternative 2 does not provide the berth availability required to properly maintain the feed stock stream adequately. Alternative 1A has some marginal weaknesses from the cost and maintenance perspectives, but overall provides the best solution for this site.

Appendix A

Meeting Notes

MEETING SUMMARY **CH2MHILL**

Oregon LNG – Columbia River Bar Pilots Meeting

ATTENDEES:	Peter Hansen, LNGDCo
	John Compere, LNGDCo
	Captain Lewin, CRBP
	Captain Johnson, CRBP
	Jeff McWilliams, CH2M HILL
	Jeff Ely, CH2M HILL
FROM:	Jeff Ely
DATE:	May 30, 2007

Location: Columbia River Bar Pilots' office in Astoria, Oregon.

The meeting began with introductions and an explanation as to why we were meeting with the Pilots. P. Hansen explained the project and the current stage of development. J. Compere described the current state of community support for the project; more are for the project than against, but some vocal opposition exists.

Capt. Lewin responded that the maritime community appears to be supportive of the project, and he expects no major issues moving forward. The primary concern is the possibility of limited access to other facilities due to the LNG terminal and associated exclusion zones.

We laid out a drawing of the current alignment, and Capt. Lewin brought out a NOAA Chart of the area for reference. He explained that the Bradwood Project study had identified one-way traffic areas along their route, and that for our project, the area from Sand Island Channel to our terminal would be one-way. However, passing would be allowed offshore and at the Bar if the weather was suitable.

The Pilots indicated that the strongest winds are from SE to SW directions. Since the site is unprotected by land mass, there will be strong forces on the vessel. Three large tugs will be required to dock the LNG carrier. The tugs will need at least 70 ton bollard pull, and there is nothing like that on the river. The tugs will also be required to have fire-fighting capability. The Pilots put lines on the tugs as soon as possible after they cross the Bar.

The Pilots discussed the strong currents along the river and indicated a possible preference to dock at slack tide. It was acceptable for the bow of the LNG carrier to point downstream, as the new vessels handle well and it should not be a problem to turn them around upon arrival. Bar closings are difficult to predict: From 1999 to 2006, the Bar has been closed a total of 57 times, with a range of 0 to 16 closings per year. The duration of the closings can range anywhere from a day to the approximate length of a tidal cycle.

We discussed the proposed alignments: Our initial idea of bringing the terminal south, closer to land in order to minimize the chance of a collision, or dredging a slip perpendicular to the channel into the existing land. They were supportive of relocating the terminal more toward the land, as the shoal adjacent to the Skipanon Waterway would cause a deep draft vessel to run aground prior to impacting the LNG terminal. However, they indicated that maintenance dredging may become an issue because we would be dredging into a much larger bank than with the original alignment. They indicated that they could maneuver the LNG Carrier into a slip, but it would have to be quite wide since the ship would be perpendicular to the current. They indicated that a slip configuration would require docking only on slack tides.

The Pilots indicated that simulator work would have to be done for the ranges, alignment, and lighting on the terminal. They also indicated that they would require a Doppler system (automatic docking) on the terminal. It is possible that additional mooring lines will be required for the Carrier to guard against incidents in periods of high wind. They indicated that operations would shut down during winds of 30 knots or more. In addition, they surmised that the USCG may require a barrier around the ship for protection against possible terror attacks.

We were informed that 70% of the ships are boarded via helicopter, the remainder by vessel.

In addition, they directed us to several web sites to gather data for LNG Carrier characteristics, winds, currents, bed load in the river, etc.

MEETING SUMMARY **CH2MHILL**

Meeting With U.S. Coast Guard

ATTENDEES: Peter Hansen, LNGDCo

Lt. Shadrack Scheirman, USCG

Jeff McWilliams, CH2M HILL

Jeff Ely, CH2M HILL

FROM: Jeff Ely

DATE: May 31, 2007

The meeting began with introductions and an explanation as to why we were meeting with the USCG. P. Hansen explained the project and the current stage of development. We asked Lt. Scheirman what concerns he had regarding the project.

He responded that he has worked on two other LNG proposals, and that safety and security are the USCG's primary concerns; he took some issue with the current location of the terminal for the same reasons as the Pilots; possibility of collision at the LNG terminal due to a ship losing steerage at the Tansy Point Turn. We explained our possible alternative of moving the terminal closer to the land, and he indicated that could be an acceptable solution to avoiding a collision at the terminal. In addition, he indicated that having the ships bow pointing upstream would be acceptable. He also suggested that we do any modeling or simulation as early in the process as possible.

He informed us that we should check the Pier and Bulkhead line to ensure the face of the dock does not extend past the line; we informed him that we knew of this requirement. He also suggested that we take a hydrographic survey, which we replied we had already completed.

He informed us that Carla Ellis of the USACE is handling all permitting activities for the LNG projects, and that we should coordinate with her as soon as practicable.

Other concerns included mooring forces and unloading activities during periods of high winds and firefighting capability at the dock. He mentioned that escorts would be required during transit of the Carrier, and that we would be required to either put a barrier around the ship or employ security vessels around the Carrier for security. The WSA will have the information necessary for the USCG process. He requested a more detailed drawing of the terminal and vicinity.

Appendix B

Wind Correlation and Return Interval Results

Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]	General regression coefficients: slope	of wind speeds: offset [m/s]	R2
671	2/1/2005	2/28/2005 23:55	3.26	557	0.656	0	0.634	2.677	0.431
558	2/1/2005 0:01	2/28/2005 23:55	4.94						

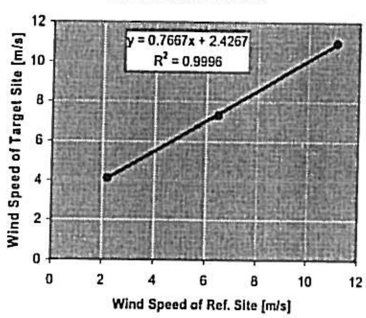
(*) of the 557 concurrent data

(**) of Target site relative to Ref.site

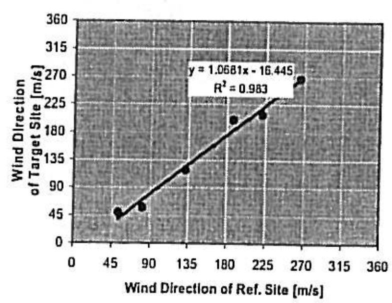
Correlations Table. Select direction of the Reference Site: All directions Included

		Wind Speeds						Directions		Turb.Intensities [%]				
Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Ref. site Mean value [m/s]	Target site Mean value [m/s]	Correlation Coefficient	Slope	Offset [m/s]	R2	Ref. site Mean value	Target site Mean value	Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	421	2.17	4.13	0.4359	0.642	2.738	0.19004			25.4	11.0	0.010	0.004	10.925
5 - 10	131	6.46	7.30	0.3058	0.445	4.432	0.09348			14.9	5.3	0.182	0.061	4.403
10 - 15	5	11.10	10.97	0.1069	0.052	10.395	0.01142			8.9	3.8	0.854	0.332	0.800
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														

All directions included



Speeds above 5 m/s



Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5	41	53	49	0.7358	7.01	7.37	-3
E	67.5	112.5	53	81	58	0.1165	6.40	8.37	-23
SE	112.5	157.5	6	132	119	-0.5456	6.02	5.94	-13
S	157.5	202.5	12	188	201	0.7338	6.77	7.69	14
SW	202.5	247.5	10	221	210	0.3387	7.40	6.73	-11
W	247.5	292.5	10	265	267	0.6097	6.30	5.80	2
NW	292.5	337.5							
N	337.5	22.5							

Correlation Summary for February 2005

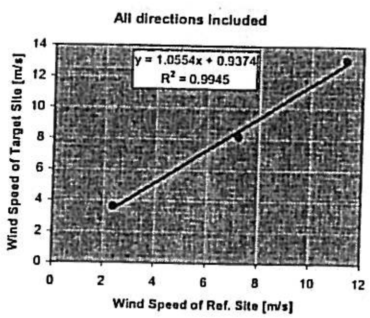
Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]	General regression coefficients slope	of wind speeds offset [m/s]	R2
741	3/1/2005	3/31/2005 23:55	3.33	733	0.822	0	0.901	1.550	0.675
735	3/1/2005 0:00	3/31/2005 15:00	4.55						

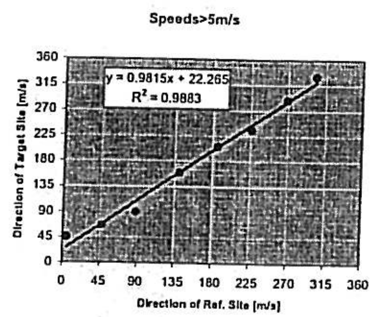
(*) of the 733 concurrent data

(**) of Target site relative to Ref.site

Correlations Table. Select direction of the Reference Site: All directions included

		Wind Speeds						Directions		Turb.Intensities [%]				
Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Ref. site Mean value [m/s]	Target site Mean value [m/s]	Correlation Coefficient	Slope	Offset [m/s]	R2	Ref. site Mean value	Target site Mean value	Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	604	2.37	3.62	0.5418	0.819	2.158	0.29334							
5 - 10	109	7.20	8.13	0.7234	1.664	-3.848	0.52324			24.8	13.2	0.085	0.034	12.405
10 - 15	20	11.33	13.11	0.4621	1.001	1.771	0.21349			15.7	10.3	0.020	0.015	10.051
15 - 20										13.2	8.2	0.101	0.023	7.860
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														





Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	87.5	11	47	66	0.6966	6.67	6.63	19
E	67.5	112.5	6	88	90	0.5373	6.58	7.04	2
SE	112.5	157.5	2	140	159	1.0000	8.25	8.81	19
S	157.5	202.5	47	186	205	0.7812	9.07	11.38	20
SW	202.5	247.5	27	226	234	0.7217	6.78	7.05	8
W	247.5	292.5	27	269	289	0.6999	7.85	8.69	20
NW	292.5	337.5	4	303	329	0.7344	8.15	8.37	27
N	337.5	22.5	2	5	45	1.0000	6.05	5.13	40

Correlation Summary for March 2005

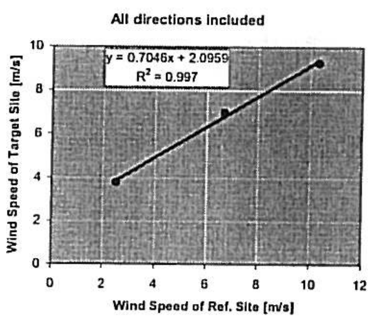
Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]	General regression coefficients	of wind speeds	
719	4/1/2005	4/30/2005 23:55	3.24				slope	offset [m/s]	R2
				716	0.766	0	0.803	1.740	0.538
717	4/1/2005 0:00	4/30/2005 23:55	4.34						

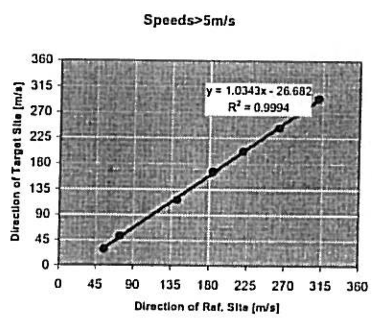
(*) of the 716 concurrent data

(**) of Target site relative to Ref.site

Correlations Table. Select direction of the Reference Site: All directions included

		Wind Speeds						Directions		Turb.Intensities [%]				
Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Ref. site Mean value [m/s]	Target site Mean value [m/s]	Correlation Coefficient	Slope	Offset [m/s]	R2	Ref. site Mean value	Target site Mean value	Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	593	2.52	3.79	0.6535	0.827	1.707	0.42705			26.9	13.5	0.140	0.059	11.898
5 - 10	121	6.67	6.97	0.6014	1.326	-1.877	0.36165			15.2	8.8	0.169	0.059	7.920
10 - 15	2	10.30	9.26	#############	0.000	0.000	-3287.12476			10.7	4.7	-1.000	-0.428	9.299
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														





Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5	6	55	29	-0.2468	6.57	5.53	-26
E	67.5	112.5	3	73	52	-0.6068	6.27	7.90	-21
SE	112.5	157.5	5	142	116	0.5873	5.90	7.01	-26
S	157.5	202.5	28	184	166	0.6753	7.03	7.79	-18
SW	202.5	247.5	37	220	202	0.5999	6.56	6.44	-18
W	247.5	292.5	21	263	244	0.1767	6.37	6.29	-19
NW	292.5	337.5	20	310	295	0.7719	7.31	8.43	-15
N	337.5	22.5							

Correlation Summary for April 2005

Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]	General regression coefficients	of wind speeds	
							slope	offset [m/s]	R2
742	5/1/2005	5/31/2005 23:55	3.36	729	0.772	0	0.819	1.748	0.597
731	5/1/2005 0:00	5/31/2005 23:55	4.50						

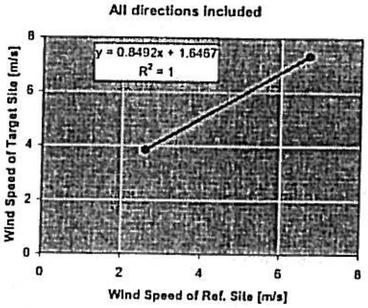
(*) of the 729 concurrent data

(**) of Target site relative to Ref.site

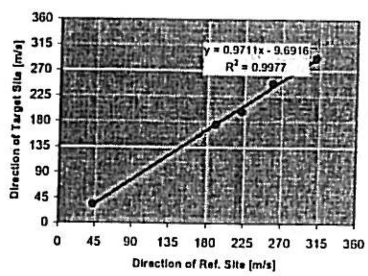
Correlations Table. Select direction of the Reference Site: All directions included

		Wind Speeds						Directions		Turb.Intensities (%)				
Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Ref. site Mean value [m/s]	Target site Mean value [m/s]	Correlation Coefficient	Slope	Offset [m/s]	R2	Ref. site Mean value	Target site Mean value	Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	592	2.58	3.84	0.6158	0.758	1.881	0.37924			21.5	12.1	-0.030	-0.015	12.459
5 - 10	136	6.69	7.33	0.6177	1.123	-0.188	0.38152			10.5	7.7	0.041	0.016	7.527
10 - 15														
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														

All directions included



Speeds>5m/s



Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5	13	42	33	0.1542	6.74	6.78	-9
E	67.5	112.5							
SE	112.5	157.5							
S	157.5	202.5	36	190	174	0.5808	7.00	8.32	-16
SW	202.5	247.5	48	221	198	0.7669	6.67	6.60	-23
W	247.5	292.5	12	258	247	0.3225	6.19	6.22	-12
NW	292.5	337.5	27	310	292	0.7116	6.73	7.88	-18
N	337.5	22.5							

Correlation Summary for May 2005

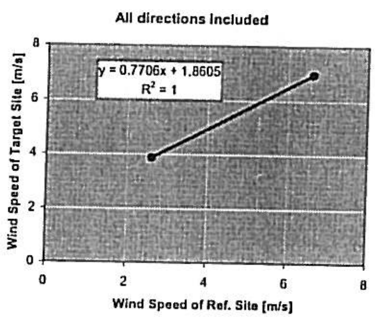
Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]	General regression coefficients: slope	of wind speeds: offset [m/s]	R2
719	6/1/2005	6/30/2005 23:55	3.19	716	0.786	60	0.741	1.958	0.618
717	6/1/2005 0:00	6/30/2005 23:55	4.32						

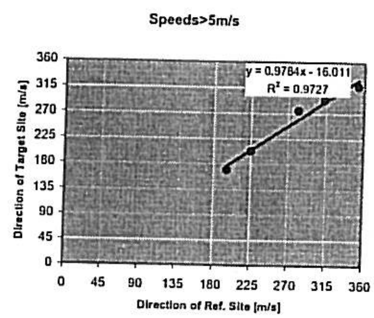
(*) of the 716 concurrent data

(**) of Target site relative to Ref.site

Correlations Table. Select direction of the Reference Site: All directions included

		Wind Speeds						Directions		Turb.Intensities (%)				
Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Ref. site Mean value [m/s]	Target site Mean value [m/s]	Correlation Coefficient	Slope	Offset [m/s]	R2	Ref. site Mean value	Target site Mean value	Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	613	2.61	3.87	0.6605	0.685	2.065	0.43620			23.9	10.9	0.104	0.030	10.231
5 - 10	102	6.62	6.96	0.7054	1.128	-0.502	0.49758			12.9	6.2	0.257	0.074	5.242
10 - 15														
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														





Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5							
E	67.5	112.5							
SE	112.5	157.5							
S	157.5	202.5	3	197	169	0.9535	6.70	5.86	-27
SW	202.5	247.5	17	225	203	0.7816	6.71	6.46	-22
W	247.5	292.5	21	281	275	0.3503	6.16	6.46	-7
NW	292.5	337.5	56	313	294	0.8029	6.91	7.65	-19
N	337.5	22.5	4	353	318	############	5.80	5.41	-35

Correlation Summary for June 2005

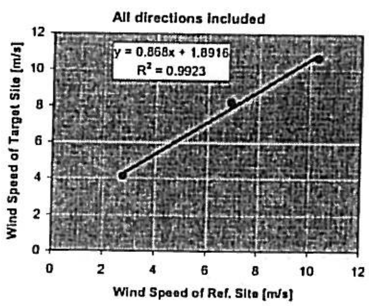
Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]	General regression coefficients	of wind speeds	
							slope	offset [m/s]	R2
742	7/1/2005	7/31/2005 23:55	3.75	736	0.808	0	0.912	1.631	0.650
738	7/1/2005 0:00	7/31/2005 23:55	5.11						

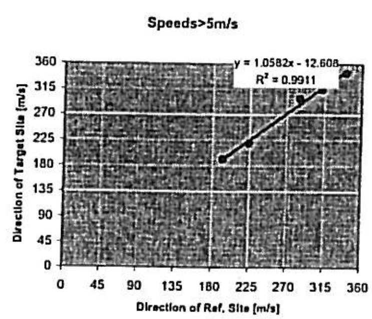
(*) of the 736 concurrent data

(**) of Target site relative to Ref.site

Correlations Table. Select direction of the Reference Site: All directions Included

		Wind Speeds						Directions		Turb.Intensities (%)				
Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Ref. site Mean value [m/s]	Target site Mean value [m/s]	Correlation Coefficient	Slope	Offset [m/s]	R2	Ref. site Mean value	Target site Mean value	Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	561	2.76	4.14	0.6043	0.786	1.963	0.36518			21.8	10.8	0.018	0.008	10.639
5 - 10	173	6.90	8.22	0.6006	0.898	2.020	0.36067			13.3	4.6	0.275	0.062	3.729
10 - 15	2	10.30	10.65	#############	0.000	0.000	-2071.61963			5.8	2.1	###########	0.000	0.000
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														





Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5							
E	67.5	112.5							
SE	112.5	157.5							
S	157.5	202.5	8	193	191	0.6961	6.43	7.04	-1
SW	202.5	247.5	16	224	219	0.5233	6.43	6.61	-4
W	247.5	292.5	13	285	299	0.4486	6.40	6.71	14
NW	292.5	337.5	136	311	315	0.6247	7.10	8.49	3
N	337.5	22.5	2	340	344	-1.0000	6.05	6.31	4

Correlation Summary for July 2005

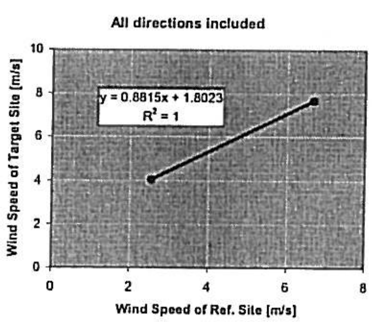
Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]	General regression coefficients of wind speeds: slope	offset [m/s]	R2
743	8/1/2005	8/31/2005 23:55	3.24	740	0.777	60	0.829	1.974	0.604
741	8/1/2005 0:00	8/31/2005 23:55	4.66						

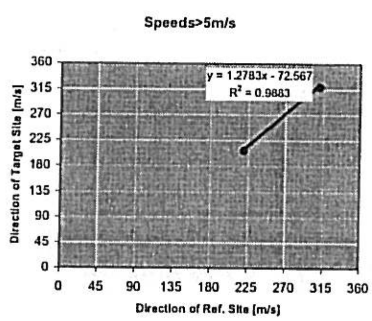
(*) of the 740 concurrent data

(**) of Target site relative to Ref.site

Correlations Table. Select direction of the Reference Site: All directions included

		Wind Speeds						Directions		Turb.Intensities (%)				
Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Ref. site Mean value (m/s)	Target site Mean value (m/s)	Correlation Coefficient	Slope	Offset (m/s)	R2	Ref. site Mean value	Target site Mean value	Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	615	2.55	4.05	0.6518	0.774	2.078	0.42479			18.3	10.4	-0.036	-0.017	10.725
5 - 10	125	6.67	7.68	0.4273	0.782	2.463	0.16256			12.3	4.6	0.222	0.046	4.066
10 - 15														
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														





Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5							
E	67.5	112.5							
SE	112.5	157.5							
S	157.5	202.5							
SW	202.5	247.5	4	220	207	0.0045	6.15	5.99	-13
W	247.5	292.5	16	286	301	0.2470	6.38	6.11	14
NW	292.5	337.5	103	310	319	0.4676	6.75	7.73	8
N	337.5	22.5							

Correlation Summary for August 2005

Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift (min)	General regression coefficients slope	of wind speeds offset [m/s]	R2
718	9/1/2005	9/30/2005 23:55	2.62	713	0.833	60	1.530	0.000	0.694
715	9/1/2005 0:00	9/30/2005 23:55	4.02						

(*) of the 713 concurrent data

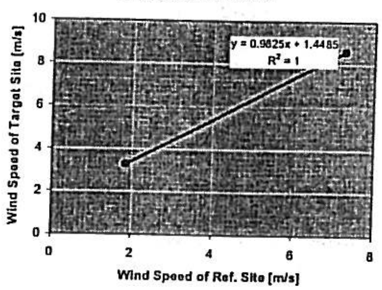
(**) of Target site relative to Ref.site

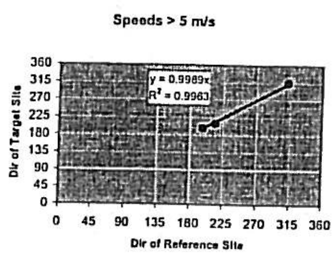
:sktop\Windcorr\AskipSep05.bin

Correlations Table. Select direction of the Reference Site: All directions included

:sktop\Windcorr\AskippredictSep05.bin

Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Wind Speeds: Ref. site Mean value (m/s)	Target site Mean value [m/s]	Correlation Coefficient	Slope	Offset [m/s]	R2	Directions: Ref. site Mean value	Target site Mean value	Turb.Intensities [%]: Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	613	1.88	3.28	0.6194	1.761	0.000	0.38362			21.1	11.9	0.008	0.564	0.000
5 - 10	100	7.28	8.58	0.6055	1.182	0.000	0.36658			13.4	4.8	0.167	0.340	0.000
10 - 15														
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														





Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5							
E	67.5	112.5							
SE	112.5	157.5							
S	157.5	202.5	16	197	197	0.6902	7.82	10.03	0
SW	202.5	247.5	5	214	209	0.5868	6.64	6.58	-5
W	247.5	292.5							
NW	292.5	337.5	78	312	314	0.5938	7.19	8.49	2
N	337.5	22.5							

Correlation Summary for September 2005

Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]	General regression coefficients of wind speeds: slope	offset [m/s]	R2
743	10/1/2005	10/31/2005 23:55	2.62	743	0.736	0	1.516	0.000	0.542
744	10/1/2005 0:00	10/31/2005 23:56	3.97						

(*) of the 743 concurrent data

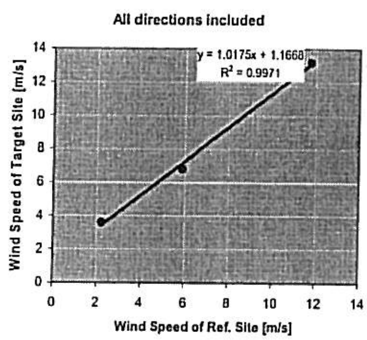
(**) of Target site relative to Ref.site

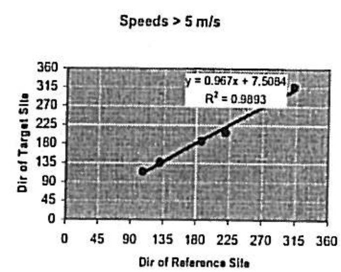
ısktop\Windcorr\AskiOct05.bin

Correlations Table. Select direction of the Reference Site: All directions included

ısktop\Windcorr\AskipredictOct05.bin

	Wind Speeds							Directions		Turb.Intensities [%]				
Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Ref. site Mean value [m/s]	Target site Mean value [m/s]	Correlation Coefficient	Slope	Offset [m/s]	R2	Ref. site Mean value	Target site Mean value	Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	667	2.21	3.61	0.5730	1.629	0.000	0.32829			25.6	9.4	0.078	0.367	0.000
5 - 10	72	5.88	6.84	0.4014	1.164	0.000	0.16115			15.0	8.4	0.067	0.556	0.000
10 - 15	4	11.75	13.24	0.6726	1.127	0.000	0.45234			13.6	7.0	0.217	0.513	0.000
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														





Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5							
E	67.5	112.5	9	107	115	-0.5310	6.00	7.46	8
SE	112.5	157.5	5	130	136	0.3171	5.60	7.27	6
S	157.5	202.5	47	187	187	0.8071	6.43	7.28	0
SW	202.5	247.5	8	220	207	0.7273	8.25	7.65	-13
W	247.5	292.5							
NW	292.5	337.5	5	312	317	0.0709	5.20	6.21	5
N	337.5	22.5							

Correlation Summary for October 2005

Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]
719	11/1/2005	11/30/2005 23:55	2.60
719	11/1/2005 0:00	11/30/2005 23:55	5.35

(*) of the 718 concurrent data

Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]
718	0.491	0

(**) of Target site relative to Ref.site

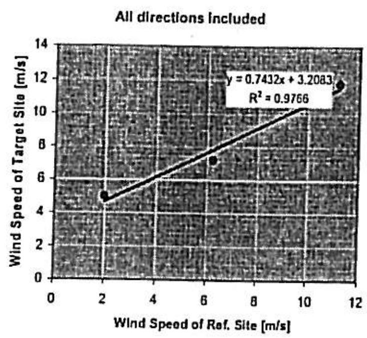
General regression coefficients of wind speeds		
slope	offset [m/s]	R2
2.056	0.000	0.241

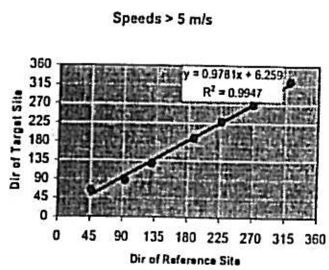
esktop\Windcorr\AskipNov05.bin

Correlations Table. Select direction of the Reference Site: All directions included

esktop\Windcorr\AskippredictNov05.bin

	Wind Speeds							Directions		Turb.Intensities [%]				
Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Ref. site Mean value [m/s]	Target site Mean value [m/s]	Correlation Coefficient	Slope	Offset [m/s]	R2	Ref. site Mean value	Target site Mean value	Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	618	1.98	5.01	0.3649	2.533	0.000	0.13315			27.9	8.9	0.051	0.318	0.000
5 - 10	95	8.21	7.21	0.3538	1.181	0.000	0.12502			23.6	8.9	0.113	0.377	0.000
10 - 15	5	11.20	11.81	0.5394	1.055	0.000	0.29091			12.8	13.6	0.796	1.058	0.000
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														





Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5	10	46	63	0.2403	5.50	8.02	17
E	67.5	112.5	15	93	87	0.0798	8.20	8.05	-6
SE	112.5	157.5	2	130	128	############	7.00	9.24	-2
S	157.5	202.5	23	188	188	0.7388	7.22	7.90	1
SW	202.5	247.5	20	226	229	0.6355	6.25	6.51	3
W	247.5	292.5	27	270	270	0.7496	6.52	7.13	0
NW	292.5	337.5	3	320	322	0.9260	5.67	6.74	2
N	337.5	22.5							

Correlation Summary for November 2005

Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]	General regression coefficients of wind speeds slope	offset [m/s]	R2
718	12/1/2005	12/31/2005 23:55	3.76	713	0.569	0	1.890	0.000	0.324
739	12/1/2005 0:00	12/31/2005 23:55	7.10						

(*) of the 713 concurrent data

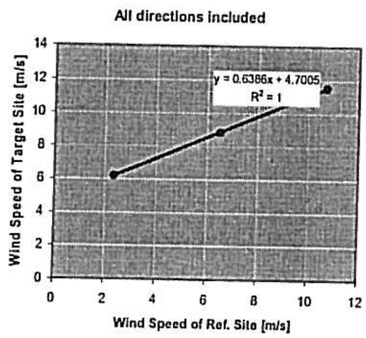
(**) of Target site relative to Ref.site

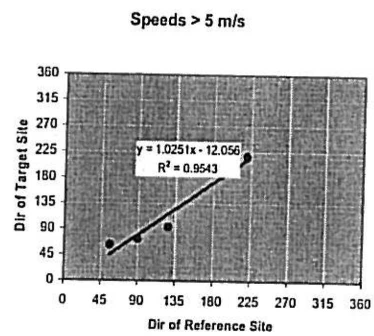
esktop\Windcorr\AskipDec05.bin

Correlations Table. Select direction of the Reference Site: All directions included

esktop\Windcorr\AskippredictDec05.bin

		Wind Speeds						Directions		Turb.Intensities [%]				
Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Ref. site Mean value (m/s)	Target site Mean value (m/s)	Correlation Coefficient	Slope	Offset (m/s)	R2	Ref. site Mean value	Target site Mean value	Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	492	2.36	6.22	0.3788	2.635	0.000	0.14346			28.6	7.3	0.152	0.256	0.000
5 - 10	201	6.49	8.82	0.3001	1.360	0.000	0.09006			15.7	6.2	0.218	0.398	0.000
10 - 15	20	10.70	11.54	0.5997	1.079	0.000	0.35969			12.2	9.5	0.257	0.772	0.000
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														





Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5	21	56	62	-0.0406	5.67	9.09	6
E	67.5	112.5	68	89	73	0.3206	6.26	9.93	-17
SE	112.5	157.5	5	126	95	-0.2877	6.00	7.99	-31
S	157.5	202.5	100	188	189	0.7046	7.70	9.18	1
SW	202.5	247.5	26	220	218	0.4430	6.42	6.72	-2
W	247.5	292.5							
NW	292.5	337.5							
N	337.5	22.5							

Correlation Summary for December 2005

Number of 1-hour averaged data	Data start at	Data end at	Mean(*) Wind Speed [m/s]	Number of sync. data	Max. Wind Speed Correlation coefficient	at a time(**) shift [min]	General regression coefficients of wind speeds slope	offset [m/s]	R2
743	1/1/2006	1/31/2006 23:55	4.02	557	0.847	0	0.913	1.728	0.717
558	1/1/2006 0:00	1/31/2006 23:55	5.42						

(*) of the 557 concurrent data

(**) of Target site relative to Ref.site

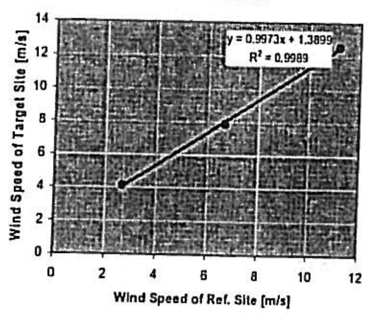
esktop\Windcorr\AskipJan06.bin

Correlations Table. Select direction of the Reference Site: All directions included

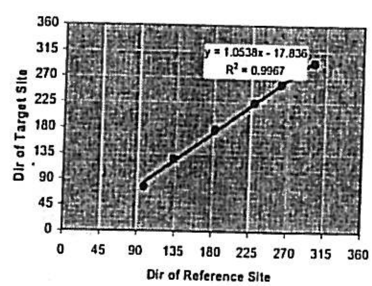
esktop\Windcorr\AskippredictJan06.bin

Wind speed bin - Ref. site [m/s]	Number of 1-hour averaged data	Wind Speeds: Ref. site Mean value [m/s]	Target site Mean value [m/s]	Correlation Coefficient	Slope	Offset [m/s]	R2	Directions: Ref. site Mean value	Target site Mean value	Turb.Intensities [%]: Ref. site Mean value	Target site Mean value	Correlation Coefficient	Slope	Offset
0 - 5	396	2.67	4.14	0.6030	0.754	2.125	0.36359			27.6	10.9	0.083	0.016	10.427
5 - 10	137	6.65	7.86	0.4624	0.785	2.640	0.21380			16.3	9.2	0.107	0.041	8.493
10 - 15	23	11.13	12.57	0.5223	1.254	-1.393	0.27277			10.1	9.5	-0.196	-0.289	12.395
15 - 20														
20 - 25														
25 - 30														
30 - 35														
35 - 40														
40 - 45														
45 - 50														
50 - 55														
55 - 60														
60 - 65														
65 - 70														
70 - 75														
75 - 80														
80 - 85														
85 - 90														
90 - 95														
95 - 100														

All directions included



Speeds > 5 m/s



Correlation results per direction (U > 5 m/s)

Direction of Ref. Site	From	To	Number of 1-hour averaged data	Mean Direction of Ref. Site	Mean Direction of Target Site	Corr. Coeff. of wind speed	Ref. site Mean wind speed	Target site Mean wind speed	Dir. Diff.
NE	22.5	67.5							
E	67.5	112.5	21	97	77	0.4962	5.86	8.58	-20
SE	112.5	157.5	9	132	126	0.8107	5.78	7.50	-6
S	157.5	202.5	56	182	178	0.7882	8.43	10.20	-4
SW	202.5	247.5	49	229	225	0.6777	7.39	7.74	-4
W	247.5	292.5	24	261	257	0.5010	6.87	6.97	-4
NW	292.5	337.5	2	300	295	1.0000	6.50	7.60	-5
N	337.5	22.5							

Correlation Results for January 2006

Extreme Wind Events At Skipanon
Long Term Climate from Correlation between Astoria Airport and Skipanon

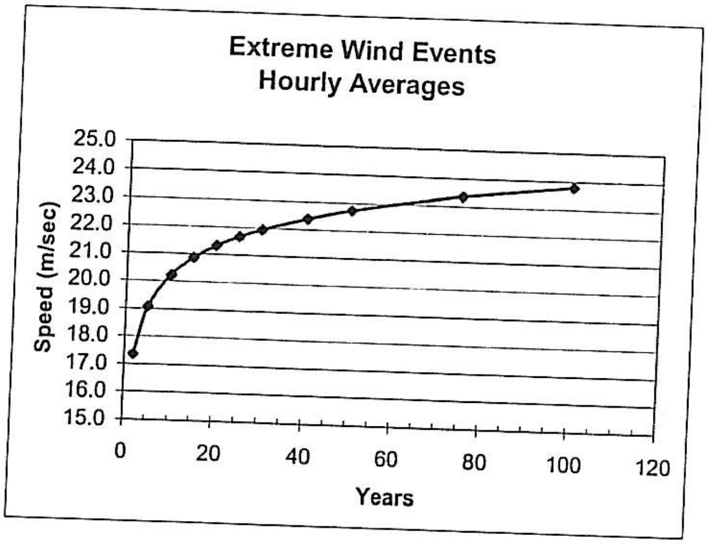
Note: Gumble Distribution Parameters Calculated by WindoGrapher (www.mistaya.ca)

CH2MHILL

Scale (beta)	1.52
Mode (mu)	16.8

Return Period Gumble Distribution
Hourly Averages

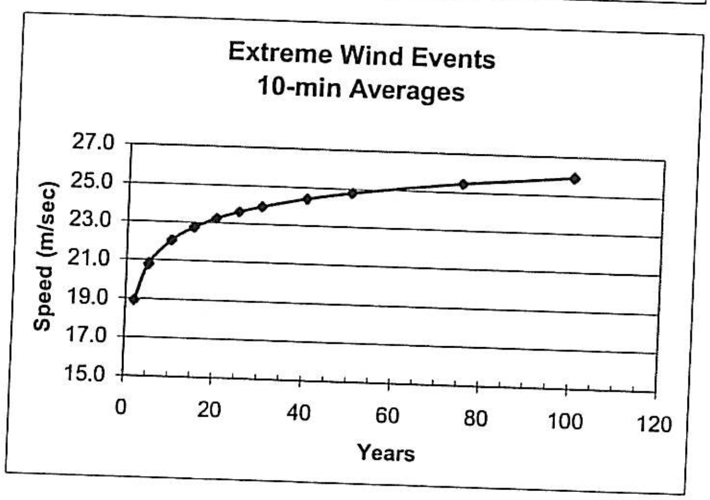
Years	Speed (m/sec)	Probability of exceedence
2	17.4	22.8%
5	19.1	11.7%
10	20.2	6.2%
15	20.9	4.2%
20	21.3	3.2%
25	21.7	2.6%
30	21.9	2.2%
40	22.4	1.6%
50	22.7	1.3%
75	23.4	0.9%
100	23.8	0.7%



Return Period Gumble Distribution
Derived 10-min Averages
TI = 0.12

Years	Speed (m/sec)	Probability of exceedence
2	18.9	12.7%
5	20.8	4.4%
10	22.0	2.0%
15	22.7	1.3%
20	23.2	0.9%
25	23.6	0.7%
30	23.9	0.6%
40	24.4	0.4%
50	24.8	0.3%
75	25.5	0.2%
100	25.9	0.2%

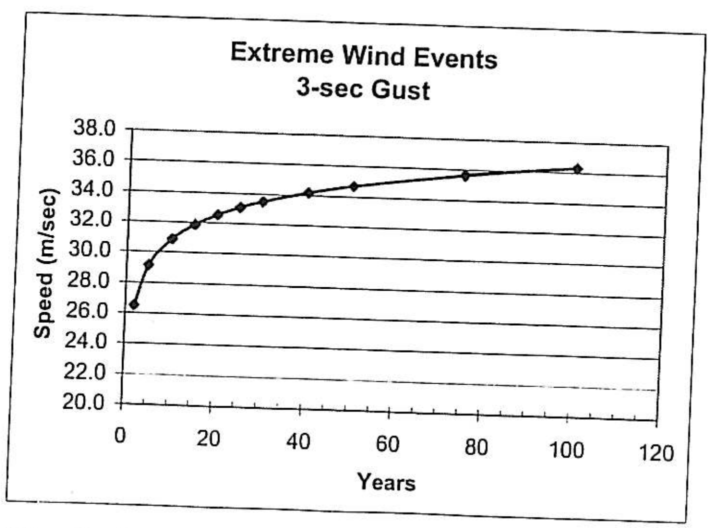
TI = Turbulence Intensity



Return Period Gumble Distribution
Derived 3-sec Gust

Years	Speed (m/s)[1]
2	26.5
5	29.1
10	30.9
15	31.8
20	32.5
25	33.1
30	33.5
40	34.2
50	34.7
75	35.6
100	36.3

Note 1: Value of gusts derived by 1.4 multiplier of the 10 min value.
Reference: IEC 61400-2



Direction
Maximum hourly wind speed generally have directions ranging between 170 and 200 degrees.

Standoff Weapons

RPG-7 (Rocket Propelled Grenade) – Made in Russia and is prevalent throughout Middle East.
- Fires an 85mm warhead with an effective range of 100m-300m depending on the proficiency of the operator
- Back blast resulting from firing the weapon extends 15m-20m behind operator
- the RPG-7VR is capable of penetrating 50 cm of steel

RPG-29 Vampir - Russian made
- in 1989 Syria was accused of giving systems to Hezbollah – known to be in Middle East
- Fires a 105mm warhead with effective range of 500m
- Warhead reportedly can penetrate 30" of rolled homgenous armor or 59" of reinforced concrete

LAW 80 (Light Anti-Armor Weapon) – US made
- Sold to Jordan, Oman,and UK among others
- Fires 94mm HEAT round (High Explosive Anti-Tank)
- Effective range of 500m

MK72 LAW – Light Anti-Armor Weapon
- Fires 66mm HEAT round that can penetrate up to 1 ft steel plate
- Max effective range is 200m

M79 Manual Rocket Launcher (OSA) – Made by Yugoslavia
- Reusable rocket launcher that fires 90mm round
- Max effective range is 600m – max range is 1960m

TOW – Tube Launched Optically Tracked – Wire Guided Missile
- US made but it is estimated that Iran has 1750 or more from days of the Shah
- weapon can fire 3 missiles in 90 secs
- Projectile able to penetrate up to 30" of armor
- Effective range 3750m (2.3miles)
- Weapons have a 20 yr maintenance free shelf life
- Primarily vehicle mounts due to weight, but there is a tripod mount
- Missiles weigh approx 50#, Launcher 205#, and Guidance Set 53#

Sources: Wikipedia & FAS – Military Analysis Network (www.fas.org)

-

Electronic Code of Federal Regulations
e-CFR ™

e-CFR Data is current as of August 3, 2007

Title 33: Navigation and Navigable Waters

PART 165—REGULATED NAVIGATION AREAS AND LIMITED ACCESS AREAS
Subpart F—Specific Regulated Navigation Areas and Limited Access Areas
Thirteenth Coast Guard District

Browse Previous | Browse Next

§ 165.1318 Security and Safety Zone Regulations, Large Passenger Vessel Protection, Portland, OR Captain of the Port Zone

(a) *Notice of enforcement or suspension of enforcement.* The large passenger vessel security and safety zone established by this section will be enforced only upon notice by the Captain of the Port Portland. Captain of the Port Portland will cause notice of the enforcement of the large passenger vessel security and safety zone to be made by all appropriate means to effect the widest publicity among the affected segments of the public including publication in theFederal Registeras practicable, in accordance with 33 CFR 165.7(a). Such means of notification may also include but are not limited to, Broadcast Notice to Mariners or Local Notice to Mariners. The Captain of the Port Portland will issue a Broadcast Notice to Mariners and Local Notice to Mariners notifying the public when enforcement of the large passenger vessel security and safety zone is suspended.

(b) *Definitions.* As used in this section—

Federal Law Enforcement Officer means any employee or agent of the United States government who has the authority to carry firearms and make warrantless arrests and whose duties involve the enforcement of criminal laws of the United States.

Large passenger vessel means any vessel over 100 feet in length (33 meters) carrying passengers for hire including, but not limited to, cruise ships, auto ferries, passenger ferries, and excursion vessels.

Large passenger vessel security and safety zone is a regulated area of water, established by this section, surrounding large passenger vessels for a 500 yard radius that is necessary to provide for the security and safety of these vessels.

Navigable waters of the United States means those waters defined as such in 33 CFR part 2.

Navigation Rules means the Navigation Rules, International-Inland.

Official Patrol means those persons designated by the Captain of the Port to monitor a large passenger vessel security and safety zone, permit entry into the zone, give legally enforceable orders to persons or vessels with in the zone and take other actions authorized by the Captain of the Port. Persons authorized as Federal Law Enforcement Officers to enforce this section are designated as the Official Patrol.

Oregon Law Enforcement Officer means any Oregon Peace Officer as defined in Oregon Revised Statutes section 161.015.

Public vessel means vessels owned, chartered, or operated by the United States, or by a State or political subdivision thereof.

Washington Law Enforcement Officer means any General Authority Washington Peace Officer, Limited Authority Washington Peace Officer, or Specially Commissioned Washington Peace Officer as defined in Revised Code of Washington section 10.93.020.

(c) *Security and safety zone.* There is established a large passenger vessel security and safety zone extending for a 500 yard radius around all large passenger vessels in the navigable waters of the United States, in Portland, OR at the Columbia River Bar "C" buoy and extending eastward on the Columbia River to Kennewick, WA and upriver through Lewiston, ID on the Snake River.

(d) *Compliance.* The large passenger vessel security and safety zone established by this section remains in effect around large passenger vessels at all times, whether the large passenger vessel is underway, anchored, or moored. Upon notice of enforcement by the Captain of the Port Portland, the Coast Guard will enforce the large passenger vessel security and safety zone in accordance with rules set out in this section. Upon notice of suspension of enforcement by the Captain of the Port Portland, all persons and vessels are authorized to enter, transit, and exit the large passenger vessel security and safety zone, consistent with the Navigation Rules.

(e) *Navigation Rules.* The Navigation Rules shall apply at all times within a large passenger vessel security and safety zone.

(f) *Restrictions based on distance from large passenger vessel.* When within a large passenger vessel security and safety zone, all vessels shall operate at the minimum speed necessary to maintain a safe course and shall proceed as directed by the on-scene official patrol or large passenger vessel master. No vessel or person is allowed within 100 yards of a large passenger vessel that is underway or at anchor, unless authorized by the on-scene official patrol or large passenger vessel master.

(g) *Requesting authorization to operate within 100 yards of large passenger vessel.* To request authorization to operate within 100 yards of a large passenger vessel that is underway or at anchor, contact the on-scene official patrol or large passenger vessel master on VHF-FM channel 16 or 13.

(h) *Maneuver-restricted vessels.* When conditions permit, the on-scene official patrol or large passenger vessel master should:

(1) Permit vessels constrained by their navigational draft or restricted in their ability to maneuver to pass within 100 yards of a large passenger vessel in order to ensure a safe passage in accordance with the Navigation Rules; and

(2) Permit commercial vessels anchored in a designated anchorage area to remain at anchor within 100 yards of a passing large passenger vessel; and

(3) Permit vessels that must transit via a navigable channel or waterway to pass within 100 yards of an anchored large passenger vessel.

(i) *Stationary vessels.* When a large passenger vessel approaches within 100 yards of any vessel that is moored or anchored, the stationary vessel must stay moored or anchored while it remains with in the large passenger vessel's security and safety zone unless it is either ordered by, or given permission by the Captain of the Port Portland, his designated representative or the on-scene official patrol to do otherwise.

(j) *Exemption.* Public vessels as defined in paragraph (b) of this section are exempt from complying with paragraphs (c), (d), (f), (g), (h), and (i), of this section.

(k) *Enforcement.* Any Coast Guard commissioned, warrant or petty officer may enforce the rules in this section. In the navigable waters of the United States to which this section applies, when immediate action is required and representatives of the Coast Guard are not present or not present in sufficient force to provide effective enforcement of this section in the vicinity of a large passenger vessel, any Federal Law Enforcement Officer, Oregon Law Enforcement Officer or Washington Law Enforcement Officer may enforce the rules contained in this section pursuant to 33 CFR 6.04–11. In addition, the Captain of the Port may be assisted by other federal, state or local agencies in enforcing this section.

(l) *Waiver.* The Captain of the Port Portland may waive any of the requirements of this section for any vessel or class of vessels upon finding that a vessel or class of vessels, operational conditions or other circumstances are such that application of this section is unnecessary or impractical for the purpose of port security, safety or environmental safety.

[CGD13–03–022, 68 FR 53679, Sept. 12, 2003]

Browse Previous | Browse Next

Title 33: Navigation and Navigable Waters

PART 160—PORTS AND WATERWAYS SAFETY—GENERAL
Subpart C—Notification of Arrival, Hazardous Conditions, and Certain Dangerous Cargos

Browse Previous | Browse Next

1 § 160.206 Information required in an NOA.

(a) Each NOA must contain all of the information items specified in Table 160.206.

Table 160.206—NOA Information Items

Required information	Vessels not carrying CDC	Vessels carrying CDC	
		Vessels	Towing vessels controlling vessels carrying CDC
(1) Vessel Information:			
(i) Name;	X	X	X
(ii) Name of the registered owner;	X	X	X
(iii) Country of registry;	X	X	X
(iv) Call sign;	X	X	X
(v) International Maritime Organization (IMO) international number or, if vessel does not have an assigned IMO international number, substitute with official number;	X	X	X
(vi) Name of the operator;	X	X	X
(vii) Name of the charterer; and	X	X	X
(viii) Name of classification society	X	X	X
(2) Voyage Information:			
(i) Names of last five ports or places visited;	X	X	X
(ii) Dates of arrival and departure for last five ports or places visited;	X	X	X
(iii) For each port or place in the United States to be visited list the names of the receiving facility, the port or place, the city, and the state;	X	X	X
(iv) For each port or place in the United States to be visited, the estimated date	X	X	X

and time of arrival;			
(v) For each port or place in the United States to be visited, the estimated date and time of departure;	X	X	X
(vi) The location (port or place and country) or position (latitude and longitude or waterway and mile marker) of the vessel at the time of reporting; and	X	X	X
(vii) The name and telephone number of a 24-hour point of contact	X	X	X
(3) Cargo Information:			
(i) A general description of cargo, other than CDC, onboard the vessel (e.g.: grain, container, oil, etc.);	X	X	X
(ii) Name of each certain dangerous cargo carried, including cargo UN number, if applicable; and		X	X
(iii) Amount of each certain dangerous cargo carried		X	X
(4) Information for each Crewmember Onboard:			
(i) Full name;	X	X	X
(ii) Date of birth;	X	X	X
(iii) Nationality;	X	X	X
(iv) Passport or mariners document number (type of identification and number);	X	X	X
(v) Position or duties on the vessel; and	X	X	X
(vi) Where the crewmember embarked (list port or place and country)	X	X	X
(5) Information for each Person Onboard in Addition to Crew:			
(i) Full name;	X	X	X
(ii) Date of birth;	X	X	X
(iii) Nationality;	X	X	X
(iv) Passport number; and	X	X	X

(v) Where the person embarked (list port or place and country)	X	X	X
(6) Operational condition of equipment required by §164.35 of this chapter	X	X	X
(7) International Safety Management (ISM) Code Notice:			
(i) The date of issuance for the company's Document of Compliance certificate that covers the vessel;	X	X	X
(ii) The date of issuance for the vessel's Safety Management Certificate; and	X	X	X
(iii) The name of the Flag Administration, or the recognized organization(s) representing the vessel flag administration, that issued those certificates	X	X	X
(8) Cargo Declaration (Customs Form 1302) as described in 19 CFR 4.7	X	X	X
(9) International Ship and Port Facility Code (ISPS) Notice*:			
(i) The date of issuance for the vessel's International Ship Security Certificate (ISSC), if any;	X	X	X
(ii) Whether the ISSC, if any, is an initial Interim ISSC, subsequent and consecutive Interim ISSC, or final ISSC;	X	X	X
(iii) Declaration that the approved ship security plan, if any, is being implemented;	X	X	X
(iv) If a subsequent and consecutive Interim ISSC, the reasons therefor;	X	X	X
(v) The name and 24-hour contact information for the Company Security Officer; and	X	X	X
(vi) The name of the Flag Administration, or the recognized security organization(s) representing the vessel flag Administration that issued the ISSC.	X	X	X

*The information required by items 9(i)-(iii) need not be submitted before January 1, 2004. All other information required by item 9 need not be submitted before July 1, 2004.

(b) Vessels operating solely between ports or places in the continental United States need submit only the name of and date of arrival and departure for the last port or places visited to meet the requirements in entries (2)(i) and (ii) to Table 160.206 of this section.

(c) You may submit a copy of INS Form I–418 to meet the requirements of entries (4) and (5) in Table 160.206.

(d) Any vessel planning to enter two or more consecutive ports or places in the United States during a single voyage may submit one consolidated Notification of Arrival at least 96 hours before entering the first port or place of destination. The consolidated notice must include the name of the port or place and estimated arrival and departure date for each destination of the voyage. Any vessel submitting a consolidated notice under this section must still meet the requirements of §160.208 of this part concerning requirements for changes to an NOA.

[USCG–2002–11865, 68 FR 9543, Feb. 28, 2003, as amended by USCG–2003–14749, 68 FR 39313, July 1, 2003; 68 FR 63735, Nov. 10, 2003]

Effective Date Note: By USCG–2002–11865, 68 FR 27908, May 22, 2003, in §160.206, in paragraph (a), item (8) in table 160.206 was suspended, effective May 22, 2003.

Title 33: Navigation and Navigable Waters

PART 160—PORTS AND WATERWAYS SAFETY—GENERAL
Subpart C—Notification of Arrival, Hazardous Conditions, and Certain Dangerous Cargos

Browse Previous | Browse Next

1 § 160.212 When to submit an NOA.

(a) *Submission of NOA.* (1) Except as set out in paragraph (a)(2) of this section, all vessels must submit NOAs within the times required in paragraph (a)(3) of this section.

(2) Towing vessels, when in control of a vessel carrying CDC and operating solely between ports or places in the continental United States, must submit an NOA before departure but at least 12 hours before entering the port or place of destination.

(3) Times for submitting NOAs areas follows:

If your voyage time is—	You must submit an NOA—
(i) 96 hours or more; or	At least 96 hours before entering the port or place of destination; or
(ii) Less than 96 hours	Before departure but at least 24 hours before entering the port or place of destination.

(b) *Submission of changes to NOA.* (1) Except as set out in paragraph (b)(2) of this section, vessels must submit changes in NOA information within the times required in paragraph (b)(3) of this section.

(2) Towing vessels, when in control of a vessel carrying CDC and operating solely between ports or places in the continental United States, must submit changes to an NOA as soon as practicable but at least 6 hours before entering the port or place of destination.

(3) Times for submitting changes to NOAs are as follows:

If your remaining voyage time is—	Then you must submit changes to an NOA—
(i) 96 hours or more;	As soon as practicable but at least 24 hours before entering the port or place of destination;
(ii) Less than 96 hours but not less than 24 hours; or	As soon as practicable but at least 24 hours before entering the port or place of destination; or
(iii) Less than 24 hours	As soon as practicable but at least 12 hours before entering the port or place of destination.

(c) *Submission of the Cargo Declaration (Customs Form 1302).* (1) Except as set out in paragraph (c)(2) of this section, all vessels must submit to USCS the Cargo Declaration (Customs Form 1302) in entry (8) to Table 160.206, within the times required in paragraph (a)(3) of this section.

(2)(i) Except for vessels carrying containerized cargo or break bulk cargo, vessels carrying bulk cargo may submit the Cargo Declaration (Customs Form 1302), (Entry (8) to Table 160.206) before departure but at least 24 hours before entering the U.S. port or place of destination.

(ii) Vessels carrying break bulk cargo operating under a USCS exemption granted under 19 CFR 4.7(b)(4)(ii) may, during the effective period of the USCS exemption, submit the Cargo Declaration (Customs Form 1302), (Entry (8) to Table 160.206) before departure but at least 24 hours before entering the U.S. port or place of destination.

[USCG–2002–11865, 68 FR 9543, Feb. 28, 2003; 68 FR 63735, Nov. 10, 2003]

Effective Date Note: By USCG–2002–11865, 68 FR 27908, May 22, 2003, in §160.212, paragraph (c) was suspended, effective May 22, 2003.

SCOTT . GLOVER

Director Maritime Security Department

Nationality

USA

Profession

Maritime Transportation Specialist

Speciali ation

Maritime Security

Position in Company

Director, Maritime Security

Birthdate

02/06/1955

Year oined Company

2005

Language Ability

English – Mother Tongue

Courses Attended

California Awards for Performance Excellence. Sacramento California. July 2002.

Hazardous Materials Course Incident Commander. California Specialized Training Institute. August 2000.

National Interagency Incident Management System NIIMS (I-400) – US Coast Guard Reserve Training Center. November 1999.

Contingency Preparedness Command & Control. US Coast Guard Reserve Training Center. November 1999

International transportation. Middlesex Community College. May 1991.

Marine Surveyor Training. San Diego, CA. 1989

Hazardous Chemical Training - US Coast Guard Reserve Training Center. September 1981

Hazardous Materials and Waste Substance. Transportation Skills Program. September 1981.

Radiographic Film Interpretation. U.S. Army Materials and Mechanics Research. Feb 1980.

Experience Summary

Captain Scott Glover retired from the U.S. Coast Guard (USCG) with more than 27 years of service. During his career he worked throughout the Marine Safety & Security field holding a number of senior positions including Commanding Officer, Chief, Eleventh Coast Guard Maritime Safety & Security Division and Chief, Pacific Area Maritime Safety and Security Division. He is a maritime security specialist intimately knowledgeable in the ISPS Code, the Maritime Transportation Act (MTSA) and the U.S. Coast Guard's policies implementing the national and international requirements. He is a highly trained expert, having completed over 15 specialty courses including: Ship Security Officer (SSO), Company Security Officer (CSO) and Facility Security Officer (FSO), ISM/ISO Auditor, hazardous material transportation, hazardous material incident response, Senior Crisis Management, and Incident Command System (ICS), Engineering Officer School, Damage Control Assistant School, Senior Investigator School.

Immediately following retirement from the Coast Guard he became the Director, Port and Cargo Security for a worldwide systems integration firm specializing in information technology services and solutions.

Mr. Glover is currently Director of HPA's Maritime Security Department. He is responsible for market development and program management of HPA's maritime security projects. The Maritime Security Group addresses a variety of projects, including: assessments of port facilities compliance with the ISPS and MTSA security regulations, development of engineering solutions to port security infrastructure needs, and conducting ship, port facility and intermodal transportation security exercises.

Credentials

U.S. Naval War College, College of Naval Command and Staff, 2000.

The Johns Hopkins University
M.A., Administrative Sciences, 1991

U.S. Coast Guard Academy
B.S. in Ocean Engineering, 1976

First Assistant Engineer, Unlimited Horsepower, STCW Endorsement

ey Pro ects

HPA Inc.

Washington, D.C. (2004 - present)
Director Maritime Security Department

- **HAITI: Engineering Services for International Ship And Port Security (ISPS) Needs At Haitian Ports Of Cap Haitian, St. Marc And Port-Au-**

Prince, Program Manager. Under this contract HPA performed the following tasks:

- Conduct a physical security assessment of the three Haitian ports and identify any deficiencies with regard to the ISPS Code or the Port Facility Security Plans.
- Evaluate the feasibility and cost effectiveness of installing a CCTV system in the three ports.
- Develop conceptual plans and estimates of probable construction costs for any additional security lighting, perimeter fencing and access control infrastructure.
- Develop a prioritized list of repairs needed for the existing security lighting, perimeter fencing and access control infrastructure. Incorporate the conceptual CCTV system into the prioritized list. (2005)

- **UNITED STATES: U.S. Transportation Security Administration's (TSA) Port Security Training Readiness Exercise Program (PortStep), Program Manager.** Subcontractor on the Unitech/HPA team. The goal of this program is to develop and implement a port security intermodal transportation security exercise program for use by the national port community. As part of Team Unitech, HPA personnel will, over the next two years, conduct PortStep security exercises in 24 ports around the country. (2005 – ongoing)
- **UNITED STATES - Maryland Port Administration Remote Video Surveillance System and Enhanced Terminal Perimeter Security, Maritime Security Advisor and Project Manager.** Teamed with the Adesta Corp for completion of this multimillion dollar project. HPA is responsible for ensuring the team's solution is in compliance with the Port's Facility Security Plan and the MTSA regulations and development of all electrical power plans for the cameras and lighting systems. (2005 – ongoing)
- **HAITI: Guard Training Program In Haiti Consistent With ISPS & MTSA, Program Manager.** While completing the Engineering Services contract discussed above, HPA was awarded this competitively bid contract. This contract is intended to further CCAA'a program to ensure that Haiti's ports are in compliance with the ISPS code. The goal of this contract is to provide training to the port security forces at the three ports which will "…provide port authority guard staff tools related to controlling access and the orderly flow of goods and services in and out of the three ports." HPA was selected for the contract because our proposal was unique in two ways:
  - HPA was the only company to incorporate a basic security officer curriculum with the ISPS curriculum, arguing that ISPS training is of little value to an untrained security officer.
  - HPA was the only company to incorporate an Overview course for senior management. The intent of the Overview course was to provide the senior personnel with an understanding of the policies and procedures being taught to the security officers and the impact these new policies and procedures may have on their stakeholders – i.e. customers of the ports, longshoremen, etc. (2005 - ongoing)
- **HAITI: Drills and Exercises Program at Haitian Ports of Cap Haitian, St. Marc and Port au Prince, Program Manager.** Developed comprehensive training curriculum in both English and Creole for the Haitian National Port Authority officials. Training was in-depth, including not only the development of ISPS compliant security drills and exercises, but also the actual execution of the drills and exercises. HPA presented the training program at the Ports of Port au Prince and Cap Haitian, ensuring the participation of personnel from many disciplines, including the Haitian National Police, Customs, Immigration, Coast Guard, the United Nations, and a number of private facility operators. (2005)
- **BELIZE: Port Assessment and Tailored Training In Belize, Program Manager.** HPA was contracted by the Organization of American States ("OAS") to analyze port security practices for the major ports in Belize and to then deliver focused technical assistance to enable ports and the government of Belize to meet the security requirements of the International Ship and Port Security Code ("ISPS), and to strengthen their capabilities in cargo security, customs and immigration controls, police patrolling and other issues related to port security. (2005 – ongoing)
- **UNITED STATES: Waterways Suitability Assessment (WSA) for the Proposed Sparrows Point LNG Receiving Terminal**

  The U.S. is significantly increasing its imports of liquefied natural gas. HPA was contracted to develop the Waterway Suitability Assessment for a

proposed new LNG facility to be developed at Sparrows Point MD. The intent of the WSA is to provide to the Coast Guard COTP the information he or she needs to assess the proposed LNG marine operations and fulfill their commitment to the Federal Energy Regulatory Commission to provide input to their Environmental Impact Statement (EIS). The WSA identifies and evaluates all credible security threats and safety hazards for LNG marine transportation for the entire transit route in U.S. waters, and identify appropriate risk management strategies to address the identified threats and hazards. A major goal of the WSA is to identify what resources (federal, state, local and private sector) will be needed to carry out the identified risk management strategies, what resources are currently available, and clearly defining the gaps between the required resources and the available resources. (Mar 2005 – Oct 2006)

- **QATAR: Qatar Petroleum Ras Laffan Port Expansion Project.** The Ras Laffan Port Expansion Project is intended to expand the port's capacity from 4.3 billion standard cubic feet (BSCF) per annum to 35 BSCF by 2024. The expanded port will be the largest LNG export facility in the world. HPA is conducting the Front End Engineering Design (FEED) for berths and port infrastructure. This work includes a number of formal studies including an "Integrated Security Study". The goal of the Integrated Security Study is to identify gaps in the "Ras Laffan Industrial City Security Port Expansion" philosophy document and to make recommendation as to methods of correcting any deficiencies identified. The client seeks to implement a world class security program and is specifically seeking assistance in cutting edge technologies including underwater detection systems, security booms, integrated video surveillance systems, common access control system based on biometric ID cards, etc. (2006- ongoing)
- **HAITI: Cargo Container Security Program. HPA was awarded a competitive contract to develop a cargo container security program for the National Port Authority (APN) of Haiti. Program Manager. Under this contract HPA:**
    - ➢ Developed a system for selecting, on a risk basis, which cargo containers to inspect
    - ➢ Developed written qualification standards for individuals and organizations to be able to met to conduct container inspections
    - ➢ Trained selected government official; APN security personnel and pre-approved designated private contractors in the skills and tools they needed to perform the screening and inspection work
    - ➢ Developed an integrated inspection process by consolidating the container selection process, the qualification standards and the training materials into an integrated package. (May 2006 – July 2006)

.

Unisys Corporation
Director, Port and Cargo Security Programs
(2002 – 2004)

- **PHILLIPPINES: Seafarer's Identity Document (SID) System, Program Manager.** USTDA funded feasibility study addressing how the Philippine government can meet the requirements of the new International Labor Organization (ILO) Seafarer Identity Document (SID) Convention. This study was significant in that the Philippines, with over 600,000 seafarers, is the largest provider of seafarers in the world and they are the first to seriously study how to implement the new ILO requirements. (2003 – 2004)

United States Coast Guard
Pacific Area (PACAREA) (2002 -2003)
Chief, Marine Safety & Security Division

- Responsible for coordinating the efforts of the four Marine Safety District Offices and all the individual Marine Safety Offices in the Pacific Area, from the U.S. Pacific Coast to the Far East
- Integrated the fragmented maritime security tactics/plans developed by the different Districts and Marine Safety Offices following September 11, 2001 into Pacific Area wide strategies with metrics based on "best practices".
- Expanded the new Port Security standards, developing a Chief, Eleventh District Marine Safety & Security Division Area wide.

United States Coast Guard
11th Coast Guard District (2001 – 2002)
Chief, Marine Safety & Security Division

- Just prior to the attacks of 9/11 led the new Eleventh Coast Guard District Marine Safety & Security Division. Designed complete operational infrastructure including staffing, budgets, facility

management, policy / procedures and regulatory compliance:

- Envisioned and executed Division's strategic focus, performance measurement metrics, Standard Operating Procedures for each program, and comprehensive staff training.

• Coordinated the operations of the three Marine Safety Offices responsible for California, Nevada & Arizona. (2002)
• Led the development of the first District-wide "Waterfront Facility Physical Security Standards" which were later incorporated into the Pacific Area standards and finally the new national required under the new Maritime Transportation Security Act 2002. (2002)
• Led the development of the first "Sea Marshal" program for the protection of the port infrastructure from large commercial vessels. This program was so successful that it was later extended nationwide under the Maritime Transportation Safety Act 2002. (2002)

United States Coast Guard
Commander Marianas Section, Commanding Officer, Marine Safety Office Guam (1998-2001)

• Responsible for two distinct operations: Search and Rescue / Law Enforcement, and Marine Safety spanning 2 million square miles of the Western Pacific Ocean.
• As Commander Marianas Section, conceived and orchestrated a voluntary joint Search and Rescue (SAR) program ("Group Guam") that formally synergized and unified the efforts of the Navy, Air Force, Police, Fire Departments, INS and Coast Guard for SAR efforts.
• As Commanding Officer of the Guam Marine Safety Office, oversaw all area Marine Safety operations:
  - Inspection of U.S. and foreign flag commercial vessels entering the port.
  - Inspection of all port facilities: oil and hazardous materials.
  - Investigation of maritime accidents.
• Designed risk management programs for ship and facility operations using the Malcolm Baldrige Risk Management approach. Demonstrated a 40% reduction in risk for passenger vessels and a 30% reduction for oil facilities for 3 years:
  - Led the Area Committee established under the National Response Plan. The Area Committee consisted of representatives from throughout the community to develop plans to respond to different incidents including oil spills, hazardous material spills, collisions, environmental disasters, etc.
  - Led three Preparedness and Response Exercise Program (PREP) exercises
• Federal On Scene Coordinator (FOSC) for several hazmat incidents including nerve gas and ammonia responses.
• Launched an all-encompassing facilities upgrade and modernization "Base Improvement Program" for the Base's multi-buildings which involved considerable rehabilitation, landscape engineering, and renewed compliance monitoring procedures that dramatically enhanced environmental and hazardous material compliance.

United States Coast Guard
Executive Officer, Marine Safety Office, Jacksonville, Florida (1995-1998)

• Built operational infrastructure for Jacksonville office and led unit to be recognized as the "Coast Guard Center of Excellence" for incorporating Baldrige criteria and objective Risk Management techniques into the strategic planning and daily operations of the office:
  - Led office to win the prestigious Florida Sterling Performance Award, the Commandant's Quality Award (three times), and the Vice President's Hammer Award.
• Created and served as the inaugural chairperson for the Jacksonville Waterways Management Council, a 70+ member organization tasked with partnering with the Coast Guard, industry and other government stakeholders that developed solutions to navigation safety and environmental protection issues in the port of Jacksonville.

United States Coast Guard
Commissioned Officer (1976 – 1995)

• Coast Guard Headquarters. Deputy Chief Licensing Office. Responsible for U.S. participation in development of the revised Standards of Training Certification and Watchkeeping Convention. (1991 – 1995)
• Industry Training. One year tour assigned to a commercial shipping company to study maritime industry. (1990 – 1991)

SCOTT . GLOVER

Director Maritime Security Department

- Department Head Marine Safety Office Baltimore, MD. (1986 – 1990)
- Engineering Officer WAGB GLACIER. (1985 – 1986)
- Assistant Engineering Officer WAGB GLACIER. Contracting Officer's Technical Representative (COTAR) for the WAGB GLACIER Major Maintenance Availability. (1983 – 1985)
- Project Officer for the Polar Icebreaker WAGB GLACIER Major Maintenance Availability (MMA) contract. Led team which developed a $6 million dollar major maintenance contract for the WAGB GLACIER. (1982 – 1983)
- Marine Safety Office San Francisco, CA. (1978 – 1982)
- Student Engineer Coast Guard Polar Icebreaker WAGB NORTHWIND. (1976 – 1978)

Publications

N/A

DAVID W. RYAN

Experience Summary

Captain David Ryan, USCG (Ret) has a broad operational background, retiring from the U.S. Coast Guard in October 2005 with 30 years of service. His career included 12 years of sea going experience, which was distinguished with four successful Commanding Officer assignments. In addition to sailing off the East and West coasts of the United States, the Gulf of Mexico, the Caribbean Sea, the Bering Sea, and the Great Lakes, he commanded a cutter that deployed to the Persian Gulf and circumnavigated the world. His shore assignments involved management of programs in all aspects of Coast Guard maritime operations, including law enforcement, search and rescue, defense operations, and maritime homeland security (MHS). He held a number of senior staff positions, including Chief of Staff of the Seventeenth Coast Guard District, Chief of Operations for Pacific Area, Chief of Plans for the Navy at Western Hemisphere Command, Branch Chief in the Defense Operations Division of HQ, and Chief of the Maritime Law Enforcement Section in District Seven.

While his last two staff assignments involved all Coast Guard operational missions, there was a heavy emphasis on maritime security post 9/11. As Chief of Operations, he was instrumental in developing the Coast Guard operational tasking order that set standards of security operation to mitigate risk and respond to threats. Risk based decision making (RBDM) was used to prioritize perceived risk in order to develop tiered security conditions with applicable standards that were sustainable given the available assets. He was involved in the Pacific Area staff effort that contributed towards development and implementation of the Port Security Risk Assessment Tool (PSRAT). As Chief of Staff of the Seventeenth District, he oversaw the staff effort that implemented the PSRAT and the Maritime Transportation Security Act (MTSA) implementation for Alaska. Both assignments involved coordination of actual security responses and numerous maritime security exercises.

He has considerable experience employing operational risk management (ORM) from both his staff assignments and shipboard experience. He routinely exercised ORM on ships to determine the level of risk entering and leaving ports and conducting major shipboard evolutions, such as towing or gunnery exercises. As the Area Operations Officer, he reviewed readiness reports, which assigned weighted values to equipment casualties, personnel shortfalls, etc. to determine the risk involved in deploying cutters and aircraft on various patrols. His staff also used a form of relative ranking and checklist methods to determine patrol assignment priorities.

He has extensive experience working with federal, state, and local agencies, DOD, and the private sector to conduct and coordinate operations and exercises. He participated in major homeland security exercises involving Northern Command, PAC Fleet, Third Fleet, LANT Fleet, and Alaska Command as well as a host of law enforcement agencies, disaster response agencies, and state emergency response organizations. Each exercise developed maritime security threat scenarios that required risk analysis and response.

Credentials

U.S. Naval War College
M.A., National Security & Strategic Studies, 1991
Salve Regina College
M.S., Management, 1991
U.S. Coast Guard Academy
B.S. in Marine Science, 1975

ey Assignments

- **Chief of Staff** **2003-2005**
  Seventeenth Coast Guard District
  - Led district staff of 244 people to plan operations, manage programs, maintain units, and support the 2400 personnel district-wide.
  - Coordinated extensively with the Governor of Alaska's office following grounding events of a ferry and a tanker to ensure the state and the feds spoke with one voice and that there was a smooth establishment of incident commands. Contributed to efficient recovery, salvage, and cleanup operations.
  - Mitigated risk to Alaskan cruise ship industry by initiating development of security zones around the vessels and contracting the Alaska Marine Exchange for real time tracking.
  - Was acting District Commander when a perceived threat necessitated a surge response in the port of Valdez. Concurred with the Captain of the Port recommendation to close the port and ensured that decision was accepted up the chain of command. Resumed port operations incrementally, managing risk and balancing cost of lost operations.

- Oversaw staff participation in MHS exercises Unified Defense 04 and Northern Edge 05, involving federal, state, and local agencies as active participants throughout Alaska.

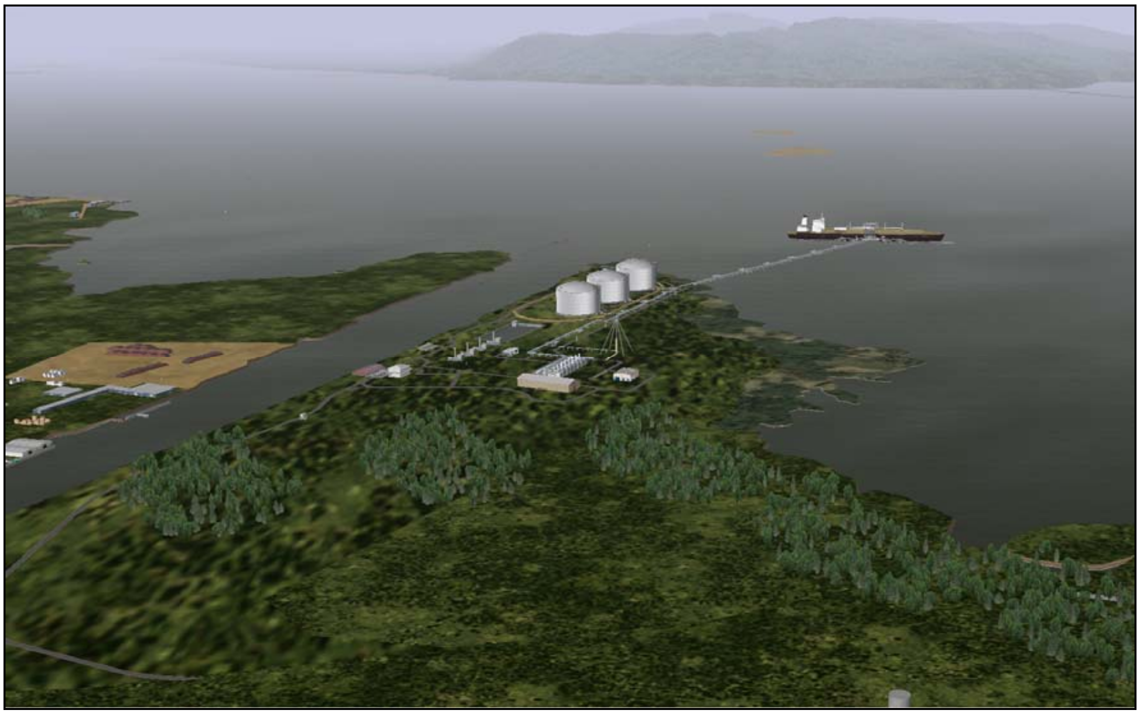
- **Chief of Operations 2001-2003**
  Coast Guard Pacific Area, San Francisco
  - Planned and oversaw execution of operations within Pacific area, including drug interdiction, fisheries enforcement, search and rescue, defense operations, and aids to navigation.
  - Oversaw program management of operational forces, including 16 major cutters, 3 port security units, and a tactical law enforcement team. Developed cutter and aircraft operations schedules.
  - Directed operational response to 9/11 attack involving every operational resource in Pacific Area and reserve personnel.
  - Coordinated extensively with numerous CG staffs and DOD to gradually draw down MHS operations and develop risk based levels of operations. Participated in the development of the operations order issued by HQ creating maritime security levels.
  - Developed operational requirements to acquire additional assets to conduct MHS operations and resume traditional CG missions.
  - Coordinated with San Francisco pilots association to initiate the Sea Marshall program as a mitigating response to the perceived terrorist threat post 9/11.

- **Commanding Officer 2001-2003**
  Coast Guard Cutter SHERMAN, San Francisco
  - Led crew of 175 on a variety of missions, including fisheries law enforcement, drug interdiction, search and rescue, and a deployment to the Persian Gulf.
  - Continuously exercised ORM while managing the intensive pace of operations in the Persian Gulf and conducting high risk boardings to stop illegal oil smuggling from Iraq.
  - Circumnavigated the world on 6 month Persian Gulf deployment, transiting to the Persian Gulf via the Pacific and Indian Ocean and returning via the Atlantic and Panama Canal.

- **Commanding Officer 1995-1997**
  Coast Guard Cutter TAMPA Portsmouth, VA
  - Led crew of 100 on numerous fisheries law enforcement, drug interdiction, and search and rescue missions.
  - Frequently operated the ship in and around the Chesapeake Bay, including anchoring in the northern Chesapeake Bay to ride out a hurricane.

- **Chief, Maritime Section 1984-1988**
  Law Enforcement Division, Seventh CG District
  - Coordinated the maritime law enforcement effort throughout the Caribbean and off the Florida coast. Over 100 seizures per year.
  - Exercised a form of relative ranking and checklist risk management to prioritize law enforcement patrol areas and asset allocation in the Caribbean.
  - Coordinated the logistics and training for the first major international, interagency drug interdiction operation in the southern Caribbean near Colombia. .It was the largest peacetime operation the Coast Guard had conducted to that date. Involved a multitude of law enforcement agencies, the intelligence community, DOD, and Dept of State. Overcame resistance and skepticism from many of the participants with this first operation to achieve a successful outcome.
  - After the first operation, coordinated similar scale operations each year thereafter.

OREGON LNG
SIMULATION REPORT



Conducted at PMI by Columbia River Bar Pilots
November 12th through 16th, 2007

Draft 12/03/2007
Revised Draft 12/19/2007
Final 01/03/2008

PACIFIC MARITIME INSTITUTE
1729 Alaskan Way S., Seattle, WA 98134
Tel. (206) 441 2880   Email: Admin@mates.org

Table of Contents

Overview

Purpose

CH2M Hill contracted with the Pacific Maritime Institute to develop and conduct simulation runs between the Columbia River Sea Buoy and a proposed Oregon LNG Terminal location on the East Skipanon Peninsula near the confluence of the Skipanon and Columbia Rivers in Warrenton, Clatsop County, OR. The intent of the simulation work was to provide the data required as part of the FERC permit application for the proposed facility.

Participants

Gary Lewin – President, Columbia River Bar Pilots
Robert Johnson – Pilot, Columbia River Bar Pilots
Daniel Jordan – Pilot, Columbia River Bar Pilots
Thron Riggs - Pilot, Columbia River Bar Pilots
Wayne Stolz - Pilot, Columbia River Bar Pilots

Observers

Jeff Ely – Terminal Designer, CH2M Hill
Peter Hanson – Oregon LNG

Summary of simulation runs

A total of forty simulation runs were completed during the five day session.

Day 1: Bar crossings inbound and outbound between Buoy 2 and Buoy 14.

Day 2: River transits inbound and negotiating turn between Buoy 12 and 14.

Day 3: River transits continued and Docking/Undocking maneuvers.

Day 4: Docking/Undocking maneuvers continued.

Day 5: Emergency simulations.

Continued on next page

Overview Continued

Simulation Location

The proposed Oregon LNG Terminal location is on the East Skipanon Peninsula near the confluence of the Skipanon and Columbia Rivers in Warrenton, Clatsop County, OR. The proposed LNG Terminal would be located on the northern portion of the East Skipanon Peninsula at approximately River Mile 11.5 of the Columbia River.

Transit Route

The ship transit required for simulation consists of seven tracks measured from the Sea Buoy to the Terminal at approximately River Mile 11.5. The track line in from the Sea Buoy intersects with the second leg that steers on the Entrance Range located on Cape Disappointment, marking the center of the Columbia River Entrance Channel. Lighted Buoys 1, 3, 7, and 9 mark the northern side of the Entrance Channel, and Buoys 2, 4, 6, and 8 mark the south side.

From the Entrance Channel, the inbound track turns right onto track 3, the Sand Island Range Channel. Lighted Buoys 10 and 11 mark the north and south sides of the channel, respectively.

Tracks 4 and 5 are short turn legs transitioning from the Sand Island Range Channel into the Desdemona Lower and Upper Shoal Channels. Lighted Buoys 12 and 14 mark the south side of the channel. The water to the north is deep well beyond the limits of the charted channel.

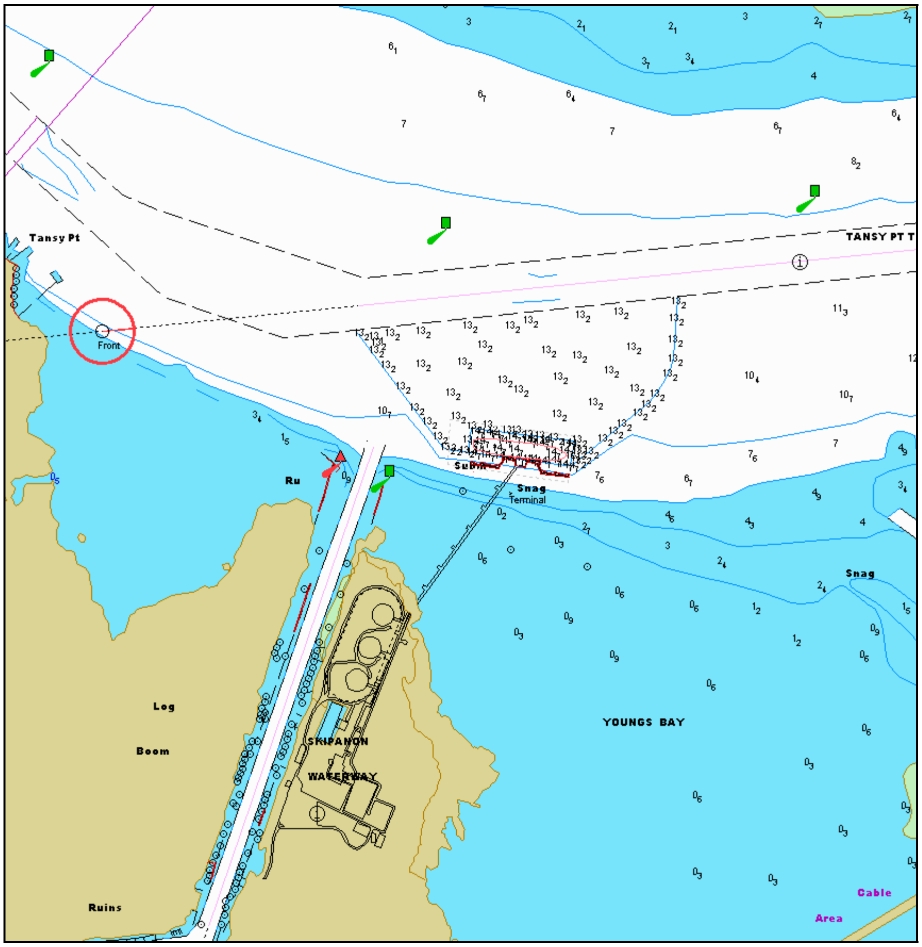
Track 6 is the Desdemona Lower and Upper Shoal Channels. The right side of the channel is marked by lighted Buoys 14, 20, and 22. The left side of the channel (inbound) is marked by lighted Buoys 21, 25, and 27.

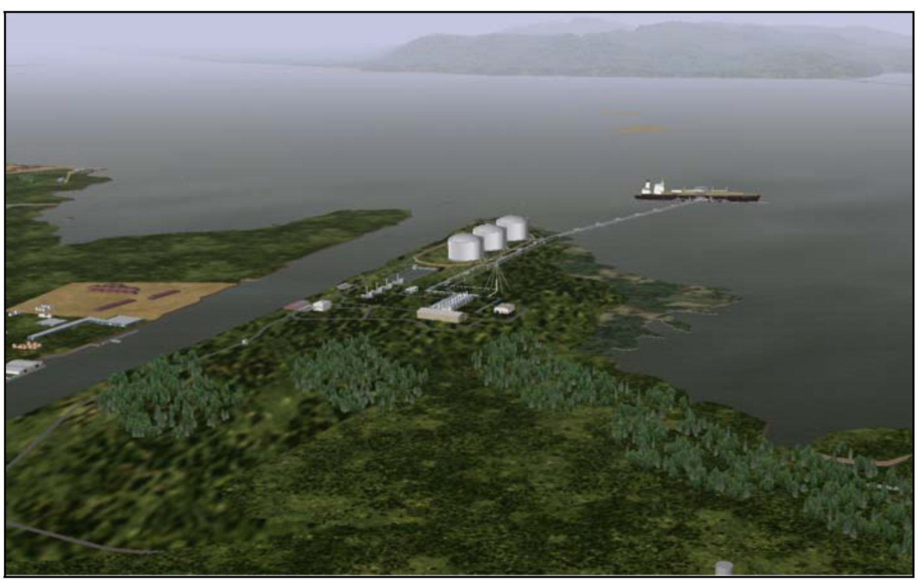
Track 7 is a turn to the south east at Tansy Point and steers toward the planned location of the LNG Terminal. This track crosses the mouth of the Skipanon Waterway.

Continued on next page

Overview Continued

East Skipanon Peninsula





Conclusions and Recommendations

Introduction

After forty documented simulation runs the pilots had a good feel for the limitations of operating these vessels.

Assumptions and Limitations

Tug Forces:
PMI used the following tug forces for this simulation:
Static bollard pull/push = 75 Metric Tons
Line forces in the Indirect Mode at 10 knots = 100 Metric Tons
Line forces in the Transverse Arrest Mode at 10 knots = 100 Metric Tons
It was assumed that the tugs operating for this terminal would be modern escort/ship assist tugs capable of indirect towing operations.
Tug forces were applied to the ship models immediately upon the request of the Pilot. In the real-world, there would be some delay in the application of force due to the time it takes to get into position. The amount of time would vary by tug Master and tug design. A fifteen second detection and response delay was used for casualty scenarios.

Bar Crossing Simulation:
Accurately simulating the exact wave and weather conditions on the Columbia River Bar is not possible with today's maritime simulators. Results obtained with respect to crossing the Columbia River Bar should be considered as guidance only and actual operational parameters may be different than those simulated.

Full-Mission Ship Simulators are generally limited to one (1) wind and wave direction. In the real-world, there can be multiple swells and substantial variance in wind directions and speeds. Depending on the combination, the conditions at the Columbia River Bar could be considerably worse than simulated.

Current Vectors:
The current vectors were based on a model provided by Coast & Harbor Engineering. Recommend actual current measurements be made and compared to the model in key areas.

Continued on next page

Conclusions and Recommendations Continued

Bar Crossings

Bar Crossings Inbound:

Simulator hydrodynamic models became difficult to handle going over the bar, with winds in excess of twenty-five (25) knots and waves up to sixteen (16) feet. This indicated the upper operational range. Please note that the combination of the specific vessel load, the presence of strong winds and currents, and multiple swell trains may substantially affect the upper limit. It was assumed that the tugs would not be able to make-up to a vessel in these conditions.

Bar Crossings Outbound:

Simulator hydrodynamic models became very difficult to control, with winds in excess of twenty-five (25) knots and seas up to twenty (20) feet. This is an indication of the upper operational range. Please note that the combination of the specific vessel load, strong winds and currents, and multiple swell trains may substantially affect the upper limit. It was assumed that the tugs would not be able to make-up to a vessel in these conditions. Also note that an ebb of 0.4 to 1.8 knots and flood of 0.7 to 3.0 knots between Buoy 4 and Buoy 14 were used during the bar crossing simulations.

River Transit

River Transits Inbound:

The simulation indicated that the ship models should tether one (1) tug through the ship's center lead aft, as soon as conditions permit, after Buoy 6 or after crossing the Bar in rough conditions (provided slowing down for the tug does not jeopardize the execution of a safe turn around Buoy 10 and Buoy 14). A second (2nd) tug should be standing by to escort the vessel, as soon as conditions permit, after crossing the Bar. The tethered tug was effective in assisting the vessel through the turns and slowing the vessel down on approach to the terminal. The Pilots were able to handle the ship models, without incident. Simulation exercises included various runs with winds up to twenty-five (25) knots and ebb or flood currents ranging from 1.2 and 2.7 knots between Buoy 10 and Tansy Point.

River Transit Outbound:

The simulation indicated that the ship models should tether one (1) tug through the ship's center lead aft during the transit from the terminal to Buoy 10, and then escort the ship to Buoy 6, conditions permitting. Also, a second (2nd) tug should escort the vessel from the Terminal to Buoy 10. The Pilots were able to handle the models, without incident, using the above arrangements.

Continued on next page

Conclusions and Recommendations Continued

River Transit continued

Simulation exercises included various runs with winds up to twenty-five (25) knots and ebb or flood currents ranging from 1.2 and 2.7 knots between Buoy 10 and Tansy Point. The tethered tug was effective in controlling the ship model during the simulated casualties.

Docking

The Pilots felt that they should always have the option of docking port or starboard side, depending on the conditions. The Pilots decided that the "starboard side to" would likely be the most common maneuver. Starboard side dockings kept the vessel heading into the simulated ebb currents. Additionally, the starboard side docking kept the relative angle of the flood current to less than ten (10) degrees off the stern.

The steady wind limitation for docking these vessels was shown to be 25 knots with ebb currents in the basin up to 1.6 knots and flood currents up to 1.4 knots. The current model was based on 90 minutes either side of Slack High Water during a moderate river flow day. In these conditions all three tugs were required to maneuver the vessel alongside. Tugs were operated at full speed on several occasions.

In winds of 10 knots the current limitations could be increased to 2.5 to 3 knots of flood or ebb in the basin and at the terminal.

Undocking

Undocking Maneuvers:

The steady wind limitations for undocking these vessels were shown to be 25 knots. Winds with a northerly component with a flood current generate the most difficult undocking conditions, because the wind and current are holding the vessel alongside the terminal. Again, with ebb currents in the basin up to 1.6 knots and flood currents up to 1.4 knots the vessels could be maneuvered off the dock and into the channel using all three tugs.

In winds with a northerly component of 10 knots or wind with a southerly component the current limitations could be increased to 2.5 to 3 knots of flood or ebb in the basin and at the terminal.

Continued on next page

Conclusions and Recommendations Continued

Casualties

LNG Ship Steering Casualties:

The Pilots were able to control the ship model after a simulated "hard over" rudder failure when the vessel's speed was less than eight (8) knots and had a tethered escort tug through the center lead aft and a second (2^{nd}) tug assisting, as directed. The ability to do so in real-world conditions will depend on the type of tug, tug Master/Pilot skills, and environmental conditions.

Other Vessel Casualties:

To minimize the risk of a transiting vessel with a casualty colliding with an LNG ship docked at the terminal, one tug should escort the transiting vessel between Buoy 27 and 31 and a second tug should be on instant standby in the terminal basin. Under most circumstances the tugs will not be required to make up to the vessel, but in the case of a vessel that is proving difficult to handle, the pilot may require the tug to make up to that vessel.

Important Notes

1. Although the LNG models proved to be controllable in these wind and current conditions, the pilots stated that during the first arrival and departure transits, environmental conditions less than those used for the simulation would be preferable.

2. While maneuvering, the pilots took full advantage of the twin propellers, rudders and a bow thruster available on the 216,000m^3 and 266,000m^3 models. Maneuvering these larger ships without the advantages of twin propellers and bow thruster will be more challenging. Naturally, the environmental limits of operation may have to be lowered in this case.

Meeting Other Vessels

The general consensus among the pilots is that they should not meet other vessels while transiting between Buoy 8 and the Terminal. During river transits with winds of 25 knots the swept path of these vessels took up much of the available channel.

Navigational Aids

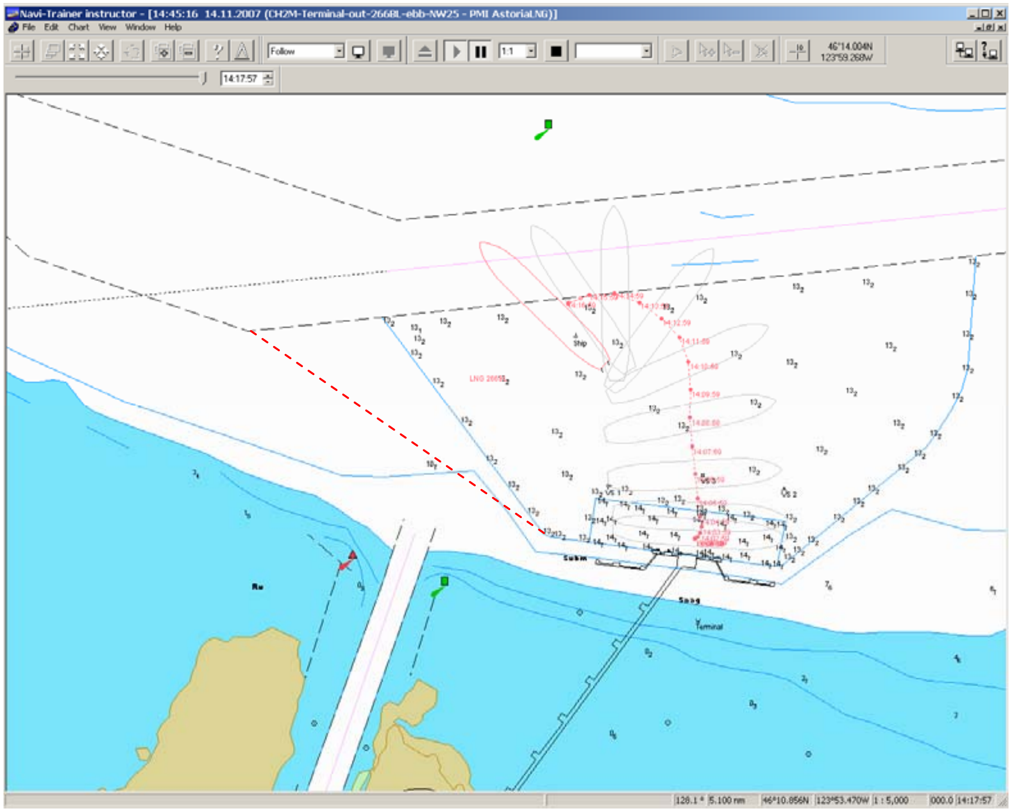
A method other than buoys should be employed to indicate the extent of the dredged basin. Buoys were not recommended because they are prone to damage by transiting vessels.

Continued on next page

Conclusions and Recommendations Continued

Dredge Turning Basin

Pilots suggest that the basin dredging be extended from the proposed SW corner to the corner of the river channel in position Latitude 46^0 11.31' N, Longitude 123^0 54.64' W indicated by the dashed line below.



Vessel Model Data

Introduction

The request for proposal from CH2M Hill asked bidders to provide LNG Carrier models with accurate hydrodynamic and structural characteristics. The Carrier models shall range from 70,000 M3 to 270,000 M3. Examples are given below:

- 70,000 – 90,000 M3
- 125,000 – 140,000 M3
- 144,000 – 170,000 M3
- 190,000 – 230,000 M3
- 255,000 – 270,000 M3

MITAGS/PMI agreed to provide the LNG Carrier models listed below.

LNG Models

Name	Capacity	Displacement[1]	Length[1]	Beam[1]	Speed[1]	Draft[1]	Propulsion
Model # 1 (Moss Type) ***LNG140BL***	140,000 M^3 **(ballast)**	81,549	298	45.8	21.2	9.3	Fixed Pitch, Single Screw, Steam Turbine
Model # 2 (Moss Type) ***LNG140LD***	140,000 M^3 **(loaded)**	108,959	298	45.8	20.3	10.8	Fixed Pitch, Single Screw, Steam Turbine
Model # 4 (Membrane) ***LNG216BL***	216,000 M^3 **(ballast)**	112,060	315	50	16.2	9.7	Fixed Pitch, Twin Screw, Low Speed Diesel
Model # 5 (Membrane) ***LNG216LD***	216,000M^3 **(loaded)**	142,550	315	50	15.3	12.0	Fixed Pitch, Twin Screw, Low Speed Diesel
Model # 6 (Membrane) ***LNG266BL***	266,000M^3 **(ballast)**	141,990	345	53.8	16.5	9.6	Fixed Pitch, Twin Screw, Low Speed Diesel
Model # 7 (Membrane) ***LNG266LD***	266,000M^3 **(loaded)**	175,640	345	53.8	15.2	12.0	Fixed Pitch, Twin Screw, Low Speed Diesel

1 Displacement in metric tonnes, dimensions in meters, speed in knots

Validation

Refer to Appendix A of this report for information on the LNGC Model Validation Tests. Maneuvering Booklets available on request.

Continued on next page

Vessel Model Data Continued

Limitations

The fidelity of the models and database are of course quite dependent upon the accuracy of the source data. Neither actual sea trial data (in deep and shallow water) nor detailed design data was available for the 216,000 m^3, and the 266,000 m^3 LNGC's at the time of the models' development and validation.

Therefore, the models' behaviors were primarily based on the mathematical calculations of the simulator. The handling characteristics were then adjusted based on the collective experience of the testing Pilots, Hydrodynamists, and Simulation Engineers. The information was then compared against known vessels of similar size and displacement. The entire process was completed in both deep and shallow water. *Note: it is strongly recommended that the models' behaviors be compared against actual sea trial data when it becomes available.* In the meantime, the existing models performance should be more than sufficient for the familiarization exercises.

The determination of "vessel squat" in shallow water is not a fully understood science. However, MITAGS/PMI' simulators provide a close approximation of vessel squat in shallow water. Again, it is highly recommended that this calculation be compared against actual measurements from the field. However, the vessels are normally operated at low speeds in the confined waters of the Columbia River to the LNG terminal. Vessel squat is reduced at slow speeds. Therefore, all parties agreed that the simulated amount of vessel squat was within the parameters for vessels of that size at that speed.

Note: One limitation of the simulator is that it cannot differentiate between a "hard" or "soft" bottom. Therefore, if the simulator calculates an underkeel clearance of "zero" on any part of the vessel, the simulation exercise will stop immediately, even though in the reality the vessel would continue its movement over a soft mud bottom.

Continued on next page

Vessel Model Data Continued

Indirect, Powered Indirect and Direct Forces

PMI used vector forces based on the information shown in the table below to simulate the forces generated by a modern escort azimuth stern drive tug rated at 75T Bollard Pull.

ASD 7 Tons			
	Indirect 4 Full	Powered Indirect Full	Direct Full
Ship Speed	Metric Tons		
	No	No	7
1	No	No	6
2	7	No	
3	1	No	3
4	2	3	2
	3	7	No
6	6	8	No
7	8	8	No
8	8		No
		No	No
1	1	No	No

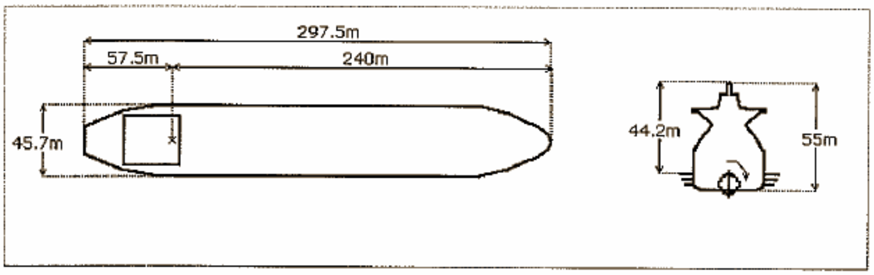
Continued on next page

Vessel Model Data Continued

LNG 140
Loaded

PILOT CARD					
Ship name	LNG140FL_M8_S3 v34.54.VSY			Date	9.11.2007
IMO Number		Call Sign		Year built	
Load Condition	Full load				
Displacement	108959 tonnes		Draft forward	10.75 m / 35 ft 4 in	
Deadweight	68200 tonnes		Draft forward extreme	10.75 m / 35 ft 4 in	
Capacity	N/A		Draft after	10.75 m / 35 ft 4 in	
Air draft	44.25 m / 145 ft 6 in		Draft after extreme	10.75 m / 35 ft 4 in	

Ship's Particulars			
Length overall	297.5 m	Type of bow	Bulbous
Breadth	45.75 m	Type of stern	Transom
Anchor Chain(Port)	15 shackles		
Anchor Chain(Starboard)	15 shackles		
Anchor Chain(Stern)	N/A shackles	(1 shackle =27.5 m / 15 fathoms)	



Steering characteristics			
Rudder(s) (type/No.)	Semisuspended / 1	Number of bow thrusters	1
Maximum angle	35	Power	1000 kW
Rudder angle for neutral effect	0.28 deegres	Number of stern thrusters	N/A
Hard over to over(2 pumps)	34 seconds	Power	N/A

Stoppings			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	587.5 s	11.88 cbls	Advance	4.52 cbls
HAH to HAS	619 s	9.01 cbls	Transfer	2.04 cbls
SAH to SAS	627 s	6.09 cbls	Tactical diameter	4.4 cbls

Main Engine(s)			
Type of Main Engine	Steam turbine	Number of propellors	1
Number of Main Engine(s)	1	Propellor rotation	Right
Maximum power per shaft	1 x 26800 kW	Propellor type	FPP
Astern power	51 % ahead	Min. RPM	15
Time limit astern	N/A	Full Ahead to Full Astern	170 seconds

Engine Telegraph Table

Engine order	Speed, knots	Engine power, kW	RPM	Pitch ratio
100 %	20.3	26800	89	0.84
80 %	13	7800	60	0.84
60 %	9.5	5690	45	0.84
40 %	7	3910	30	0.84
20 %	5.5	2110	15	0.84
-20 %	-3.1	1740	-25	0.84
-40 %	-4.1	3220	-34	0.84
-60 %	-5.2	4680	-41	0.84
-80 %	-5.9	6410	-48	0.84
-100 %	-5.9	6410	-48	0.84

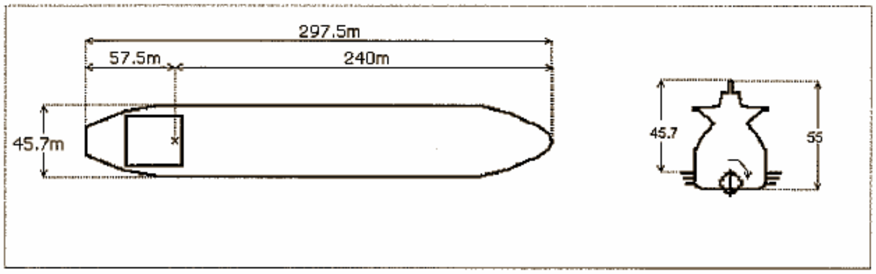
Continued on next page

Vessel Model Data Continued

LNG 140 Ballasted

PILOT CARD					
Ship name	LNG140BL_M3_S5 -			Date	9.11.2007
IMO Number		Call Sign		Year built	
Load Condition	Ballast				
Displacement	81549 tonnes		Draft forward	9.27 m / 30 ft 5 in	
Deadweight	68200 tonnes		Draft forward extreme	9.27 m / 30 ft 5 in	
Capacity	N/A		Draft after	9.27 m / 30 ft 5 in	
Air draft	45.73 m / 150 ft 5 in		Draft after extreme	9.27 m / 30 ft 5 in	

Ship's Particulars			
Length overall	297.5 m	Type of bow	Bulbous
Breadth	45.75 m	Type of stern	Transom
Anchor Chain(Port)	15 shackles		
Anchor Chain(Starboard)	15 shackles		
Anchor Chain(Stern)	N/A shackles	(1 shackle =27.5 m / 15 fathoms)	



Steering characteristics			
Rudder(s) (type/No.)	Semisuspended / 1	Number of bow thrusters	1
Maximum angle	35	Power	1000 kW
Rudder angle for neutral effect	0.12 deegres	Number of stern thrusters	N/A
Hard over to over(2 pumps)	34 seconds	Power	N/A

Stoppings			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	574 s	11.71 cbls	Advance	4.51 cbls
HAH to HAS	582.5 s	8.83 cbls	Transfer	1.9 cbls
SAH to SAS	619.5 s	6.91 cbls	Tactical diameter	4.4 cbls

Main Engine(s)			
Type of Main Engine	Steam turbine	Number of propellors	1
Number of Main Engine(s)	1	Propellor rotation	Right
Maximum power per shaft	1 x 26800 kW	Propellor type	FPP
Astern power	51 % ahead	Min. RPM	15
Time limit astern	N/A	Full Ahead to Full Astern	170 seconds

Engine Telegraph Table				
Engine order	Speed, knots	Engine power, kW	RPM	Pitch ratio
100 %	21.2	26800	89	0.84
80 %	14	7800	60	0.84
60 %	10	5690	45	0.84
40 %	8	3910	30	0.84
20 %	6	2610	15	0.84
-20 %	-3.2	1740	-25	0.84
-40 %	-4.3	3220	-34	0.84
-60 %	-5.4	4680	-41	0.84
-80 %	-6.2	6410	-48	0.84
-100 %	-6.2	6410	-48	0.84

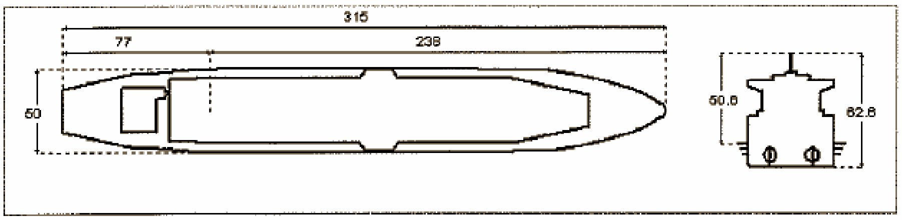
Continued on next page

Vessel Model Data Continued

LNG 216
Loaded

PILOT CARD					
Ship name	LNG216FL_M13_S5 v4.VSY			Date	9.11.2007
IMO Number		Call Sign		Year built	
Load Condition	Full load				
Displacement	142550 tones		Draft forward	12 m / 39 ft 5 in	
Deadweight	100800 tonnes		Draft forward extreme	12 m / 39 ft 5 in	
Capacity	N/A		Draft after	12 m / 39 ft 5 in	
Air draft	38.65 m / 127 ft 1 in		Draft after extreme	12 m / 39 ft 5 in	

Ship's Particulars			
Length overall	315 m	Type of bow	Bulbous
Breadth	50 m	Type of stern	Transom
Anchor Chain(Port)	15 shackles		
Anchor Chain(Starboard)	15 shackles		
Anchor Chain(Stern)	N/A shackles	(1 shackle =27.5 m / 15 fathoms)	



Steering characteristics			
Rudder(s) (type/No.)	Semisuspended / 2	Number of bow thrusters	1
Maximum angle	35	Power	2250 kW
Rudder angle for neutral effect	0 degrees	Number of stern thrusters	N/A
Hard over to over(2 pumps)	18.5 seconds	Power	N/A

Stopping			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	454.5 s	10.07 cbls	Advance	4.11 cbls
HAH to HAS	656 s	9.54 cbls	Transfer	1.98 cbls
SAH to SAS	671.5 s	7.27 cbls	Tactical diameter	4.7 cbls

Main Engine(s)			
Type of Main Engine	Slow speed diesel	Number of propellers	2
Number of Main Engine(s)	2	Propeller rotation	Outward
Maximum power per shaft	2 x 20000 kW	Propeller type	FPP
Astern power	60 % ahead	Min. RPM	25
Time limit astern	N/A	Full Ahead to Full Astern	50 seconds

Engine Telegraph Table				
Engine order	Speed, knots	Engine power, kW	RPM	Pitch ratio
100 %	15.3	15000	65	0.82
80 %	15.3	15000	65	0.82
60 %	10.8	5800	47	0.82
40 %	7.8	3500	36	0.82
20 %	5.4	1900	25	0.82
-20 %	-2.8	1400	-25	0.82
-40 %	-4.4	2900	-36	0.82
-60 %	-4.9	5000	-42	0.82
-80 %	-6.9	9000	-63	0.82
-100 %	-8.63	9000	-63	0.82

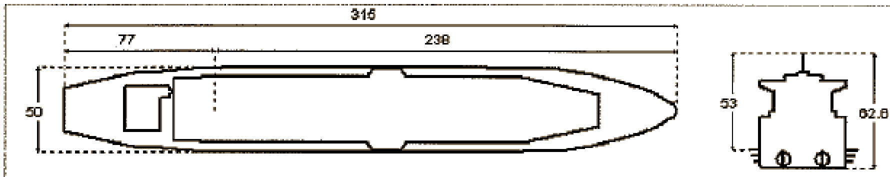
Continued on next page

Vessel Model Data Continued

LNG 216 Ballast

PILOT CARD					
Ship name	LNG216BL_M5_S3 v6.VSY			Date	9.11.2007
IMO Number		Call Sign		Year built	
Load Condition	Ballast				
Displacement	112060 tones	Draft forward		9.65 m / 31 ft 8 in	
Deadweight	100800 tonnes	Draft forward extreme		9.65 m / 31 ft 8 in	
Capacity	N/A	Draft after		9.65 m / 31 ft 8 in	
Air draft	43.35 m / 142 ft 7 in	Draft after extreme		9.65 m / 31 ft 8 in	

Ship's Particulars			
Length overall	315 m	Type of bow	Bulbous
Breadth	50 m	Type of stern	Transom
Anchor Chain(Port)	15 shackles		
Anchor Chain(Starboard)	15 shackles		
Anchor Chain(Stern)	N/A shackles	(1 shackle =27.5 m / 15 fathoms)	



Steering characteristics			
Rudder(s) (type/No.)	Semisuspended / 2	Number of bow thrusters	1
Maximum angle	35	Power	2250 kW
Rudder angle for neutral effect	0 degrees	Number of stern thrusters	N/A
Hard over to over(2 pumps)	18.5 seconds	Power	N/A

Stopping			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	396.5 s	9.4 cbls	Advance	4.41 cbls
HAH to HAS	575.5 s	8.99 cbls	Transfer	2.1 cbls
SAH to SAS	581.5 s	6.69 cbls	Tactical diameter	5.22 cbls

Main Engine(s)			
Type of Main Engine	Slow speed diesel	Number of propellers	2
Number of Main Engine(s)	2	Propeller rotation	Outward
Maximum power per shaft	2 x 20000 kW	Propeller type	FPP
Astern power	60 % ahead	Min. RPM	25
Time limit astern	N/A	Full Ahead to Full Astern	50 seconds

Engine Telegraph Table

Engine order	Speed, knots	Engine power, kW	RPM	Pitch ratio
100 %	16.2	15000	65	0.82
80 %	16.2	15000	65	0.82
60 %	11.4	5800	47	0.82
40 %	8	3500	36	0.82
20 %	5.7	1900	25	0.82
-20 %	-3.2	1400	-25	0.82
-40 %	-4.7	2900	-36	0.82
-60 %	-5.5	5000	-42	0.82
-80 %	-7.4	9000	-63	0.82
-100 %	-9.25	9000	-63	0.82

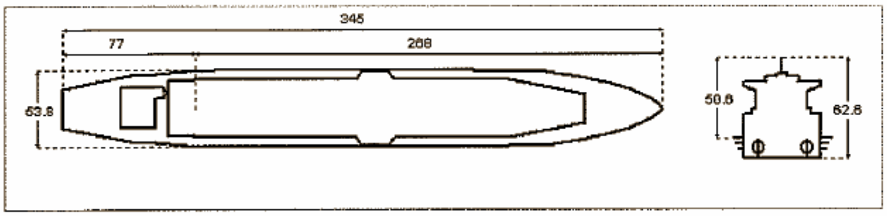
Continued on next page

Vessel Model Data Continued

LNG 266
Loaded

PILOT CARD					
Ship name	LNG266FL_M4_S12 v5.1.VSY			Date	9.11.2007
IMO Number		Call Sign		Year built	
Load Condition	Full load				
Displacement	175640 tones	Draft forward		12 m / 39 ft 5 in	
Deadweight	125700 tonnes	Draft forward extreme		12 m / 39 ft 5 in	
Capacity	N/A	Draft after		12 m / 39 ft 5 in	
Air draft	38.6 m / 126 ft 11 in	Draft after extreme		12 m / 39 ft 5 in	

Ship's Particulars			
Length overall	345 m	Type of bow	Bulbous
Breadth	53.8 m	Type of stern	Transom
Anchor Chain(Port)	15 shackles		
Anchor Chain(Starboard)	15 shackles		
Anchor Chain(Stern)	N/A shackles	(1 shackle =27.5 m / 15 fathoms)	



Steering characteristics			
Rudder(s) (type/No.)	Semisuspended / 2	Number of bow thrusters	1
Maximum angle	35	Power	2500 kW
Rudder angle for neutral effect	0 degrees	Number of stern thrusters	N/A
Hard over to over(2 pumps)	15.5 seconds	Power	N/A

Stopping			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	503 s	10.58 cbls	Advance	4.9 cbls
HAH to HAS	716.5 s	9.61 cbls	Transfer	2.41 cbls
SAH to SAS	743.5 s	7.38 cbls	Tactical diameter	5.82 cbls

Main Engine(s)			
Type of Main Engine	Slow speed diesel	Number of propellers	2
Number of Main Engine(s)	2	Propeller rotation	Outward
Maximum power per shaft	2 x 25000 kW	Propeller type	FPP
Astern power	58 % ahead	Min. RPM	25
Time limit astern	N/A	Full Ahead to Full Astern	50 seconds

Engine Telegraph Table

Engine order	Speed, knots	Engine power, kW	RPM	Pitch ratio
100 %	15.2	20000	65	0.84
80 %	15.2	20000	65	0.84
60 %	10.7	5700	45	0.84
40 %	7.7	3800	36	0.84
20 %	5.4	2000	25	0.84
-20 %	-2.8	1500	-25	0.84
-40 %	-4.4	3100	-36	0.84
-60 %	-5	6000	-42	0.84
-80 %	-6.8	10000	-63	0.84
-100 %	-8.5	10000	-63	0.84

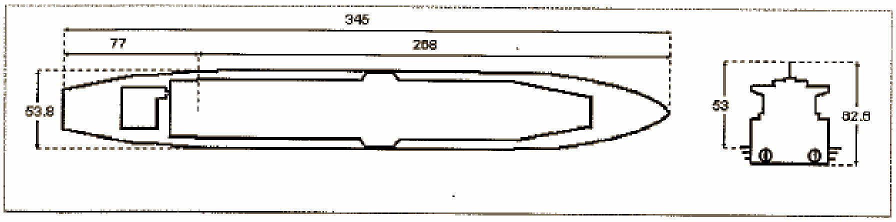
Continued on next page

Vessel Model Data Continued

LNG 266
Ballast

PILOT CARD					
Ship name	LNG266BL_M4_S4 v5.2.VSY			Date	9.11.2007
IMO Number		Call Sign		Year built	
Load Condition	Ballast				
Displacement	141990 tones		Draft forward	9.6 m / 31 ft 6 in	
Deadweight	101617 tonnes		Draft forward extreme	9.6 m / 31 ft 6 in	
Capacity	N/A		Draft after	9.6 m / 31 ft 6 in	
Air draft	43.4 m / 142 ft 9 in		Draft after extreme	9.6 m / 31 ft 6 in	

Ship's Particulars			
Length overall	345 m	Type of bow	Bulbous
Breadth	53.8 m	Type of stern	Transom
Anchor Chain(Port)	15 shackles		
Anchor Chain(Starboard)	15 shackles		
Anchor Chain(Stern)	N/A shackles	(1 shackle =27.5 m / 15 fathoms)	



Steering characteristics			
Rudder(s) (type/No.)	Semisuspended / 2	Number of bow thrusters	1
Maximum angle	35	Power	2500 kW
Rudder angle for neutral effect	0 degrees	Number of stern thrusters	N/A
Hard over to over(2 pumps)	15.5 seconds	Power	N/A

Stopping			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	442 s	10.27 cbls	Advance	4.82 cbls
HAH to HAS	619 s	9.16 cbls	Transfer	2.31 cbls
SAH to SAS	668 s	7.35 cbls	Tactical diameter	5.36 cbls

Main Engine(s)			
Type of Main Engine	Slow speed diesel	Number of propellers	2
Number of Main Engine(s)	2	Propeller rotation	Outward
Maximum power per shaft	2 x 25000 kW	Propeller type	FPP
Astern power	58 % ahead	Min. RPM	25
Time limit astern	N/A	Full Ahead to Full Astern	50 seconds

Engine Telegraph Table

Engine order	Speed, knots	Engine power, kW	RPM	Pitch ratio
100 %	16.5	20000	65	0.84
80 %	16.5	20000	65	0.84
60 %	10.9	5800	45	0.84
40 %	8	3800	36	0.84
20 %	5.7	2000	25	0.84
-20 %	-3.1	1500	-25	0.84
-40 %	-4.9	3100	-35	0.84
-60 %	-5.5	6000	-42	0.84
-80 %	-7.5	10000	-63	0.84
-100 %	-9.38	10000	-63	0.84

Currents Developed for Simulation

Introduction

Coast & Harbor Engineering Inc. was contracted by PMI to provide the current data for this simulation project.

Coast & Harbor engineers specialize in analyzing coastal physical processes and their effects on coastal zone and waterfront projects. Waves, currents, and sediment and contaminant transport are analyzed and simulated for assessing project feasibility and for planning, permitting, and design. Coast & Harbor engineers routinely develop, verify and apply sophisticated numerical modeling tools and analysis techniques. These capabilities are applied to quantify and display physical effects on the project, and minimize project effects on the environment.

Analysis and modeling tools are applied to evaluate:

- Wave Growth, Transformation and Nearshore Circulation
- Wave Setup, Runup and Overtopping
- Tide-Induced and Wind-Induced Circulation
- Sediment Transport and Erosion-Accumulation
- Water Quality
- Beach Profile Evolution
- Fate of Placed Dredged Material

For current and past projects refer to the Coast & Harbor Engineering website, www.coastharboreng.com.

Contact Information:
Scott Fenical,
110 Main Street, Suite 103
Edmonds, WA 98020
Phone: 425.778.6243
Fax: 425.778.6883

Process

Coast & Harbor Engineering, Inc. provided PMI with an animated file depicting surface currents from the mouth of the Columbia River up to the Astoria Bridge including the area of the proposed terminal and dredged basin for a 14-day period starting January 1, 2007 at 00:00 GMT.

In discussions with Gary Lewin of the Columbia River Bar Pilots three time frames were identified for use in the simulations. The time frames chosen represented an ebb and flood current 90 minutes either side of slack on a moderate flow day (3 knots max at mouth) and one ebb current 90 minutes after slack on a strong flow day (6 knots max at mouth).

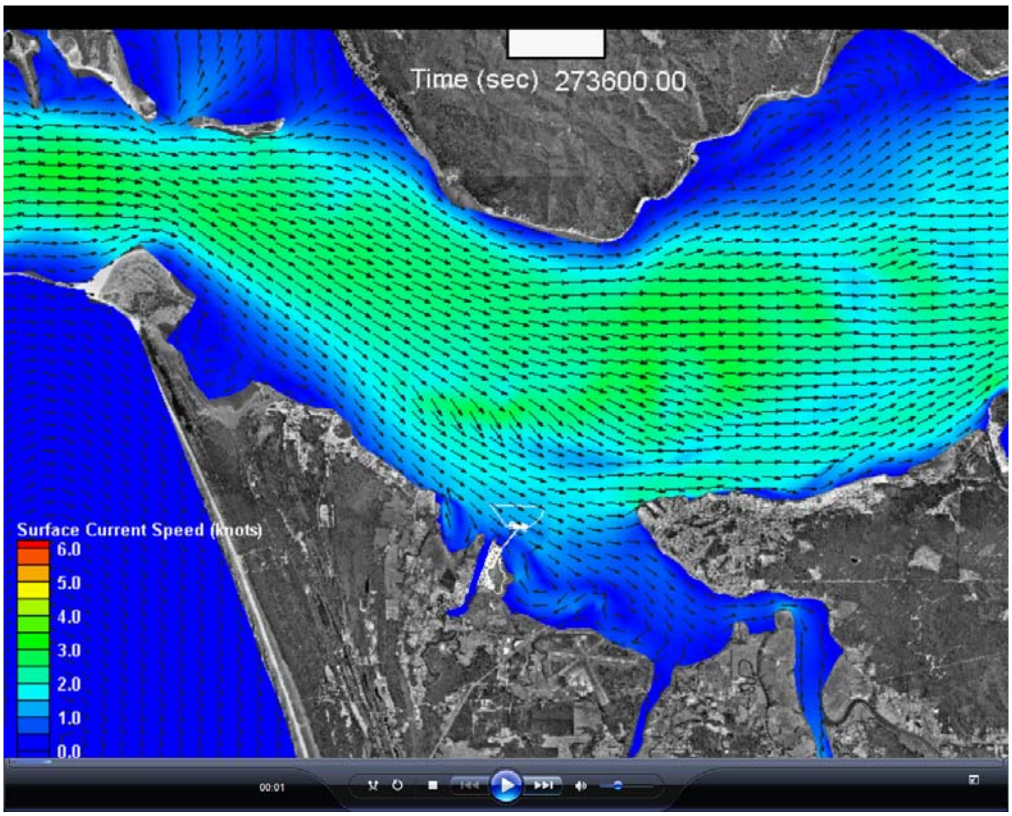
Continued on next page

Currents Developed for Simulation Continued

Base Flood

This current pattern was based on a time frame ninety minutes before the end of a moderate flood. This moderate flood attained a maximum speed of approximately 3.5 knots at the mouth of the Columbia, south of Jetty A. The imported data generated the following currents in the simulator:

Location	Direction (Deg T)	Rate (Knots)
Buoy 4	042	0.7
Buoy 8	074	2.1
Buoy 10	079	2.7
Buoy 12	092	3.0
Buoy 14	105	2.7
Buoy 20	131	1.6
Buoy 22	130	1.3
Hammond	141	1.2
Tansy Pt.	129	1.4
Basin NW	128	1.3
Basin NE	105	1.4
Basin Middle	121	1.3
At Dock	127	1.1



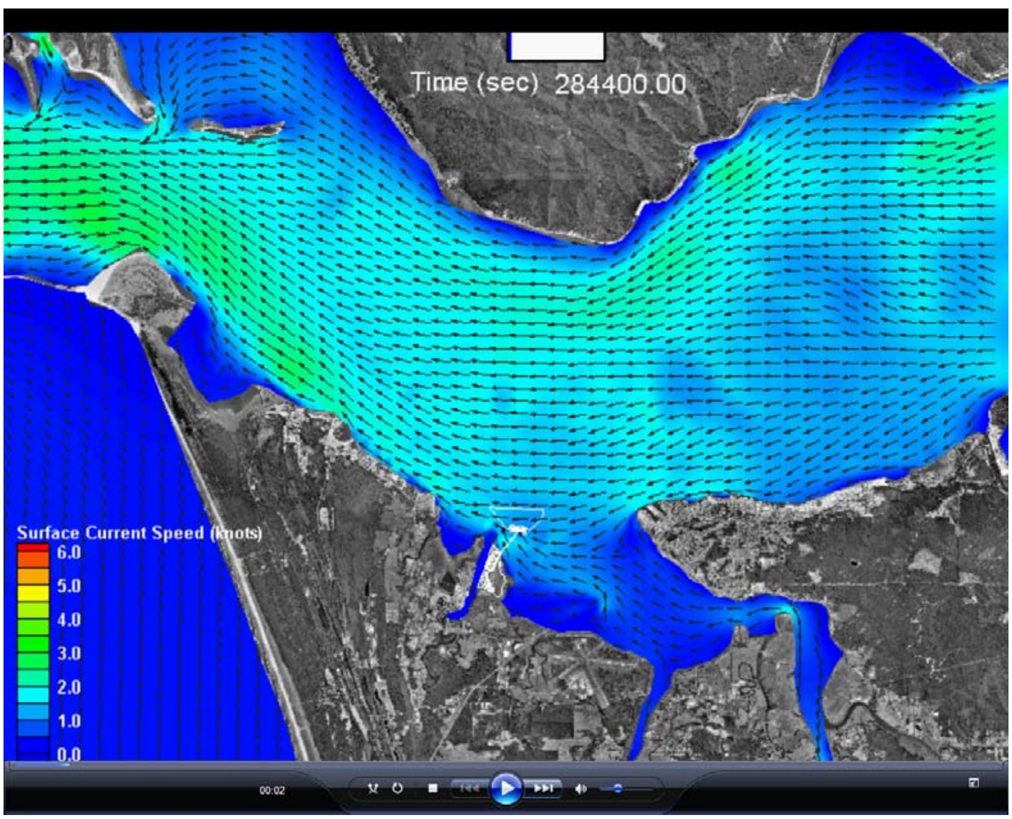
Continued on next page

Currents Developed for Simulation Continued

Base Ebb

This current pattern was based on a time frame ninety minutes after the beginning of a moderate ebb. This moderate ebb attained a maximum speed of approximately 3.5 knots at the mouth of the Columbia, south of Jetty A. The imported data generated the following currents in the simulator:

Location	Direction (Deg T)	Rate (Knots)
Buoy 4	216	0.4
Buoy 8	256	1.4
Buoy 10	263	1.7
Buoy 12	275	1.8
Buoy 14	287	1.7
Buoy 20	316	1.9
Buoy 22	310	1.7
Hammond	314	1.4
Tansy Pt.	287	1.3
Basin NW	275	1.1
Basin NE	265	0.9
Basin Middle	257	0.8
At Dock	268	0.8

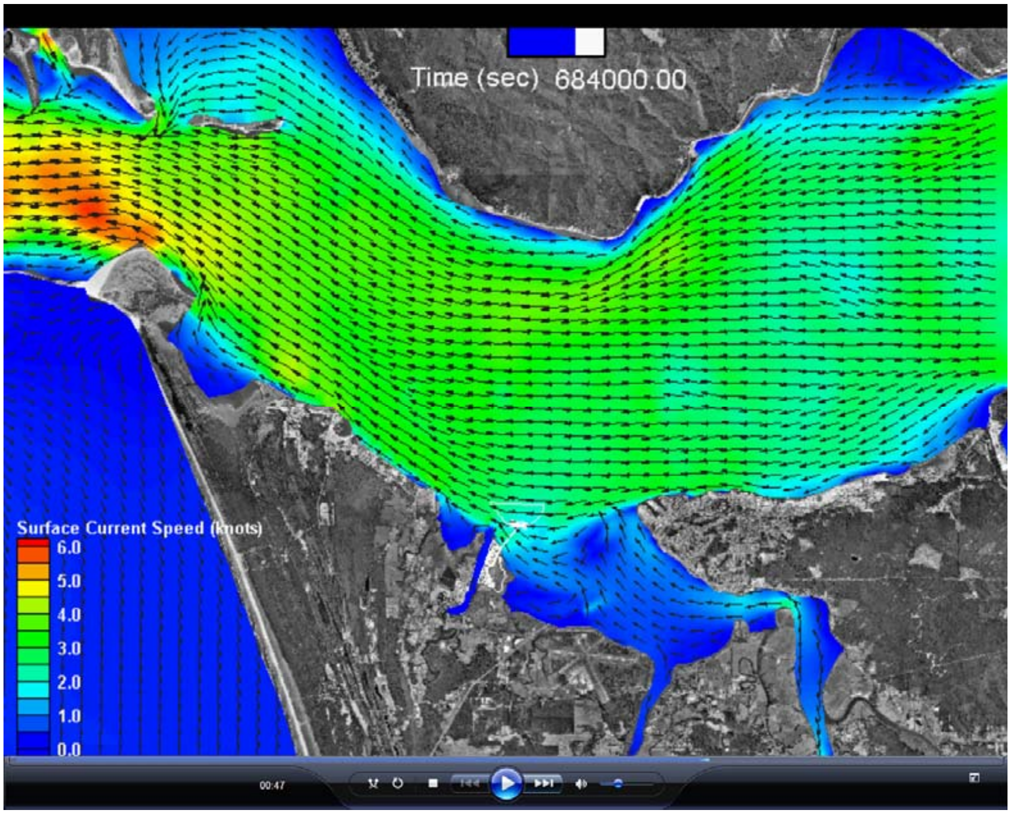


Continued on next page

Currents Developed for Simulation Continued

Moderate Ebb

This current pattern was based on a time frame ninety minutes after the beginning of a strong ebb. This strong ebb attained a maximum speed of approximately 6.0 knots at the mouth of the Columbia, south of Jetty A. This time frame generated 1.6 knots of ebb current in the proposed terminal basin.



Max Flood

In order to establish the maximum current in which the vessels could be safely docked and undocked, the “Base Flood” was enhanced with current vectors to create current flowing approximately 125 degrees at 2.5 to 3.0 knots in the basin. This current was used during simulations with winds of 10 knots.

Max Ebb

In order to establish the maximum current in which the vessels could be safely docked and undocked, the “Base Ebb” was enhanced with current vectors to create current flowing approximately 265 degrees at 2.5 to 3.0 knots in the basin. This current was used during simulations with winds of 10 knots.

Simulation Runs Table

Area Definitions Bar: Sea buoy to/from buoy R'14' River: Buoy R'14' to/from Tansy Point Terminal: Tansy Point to/from Terminal

Actual Simulation Runs (CH2M Pro ect)

No.	Area	In Out	Ship	Current Tide	Winds	Waves	Visibility	Tugs Used	Emergencies
1	All	In	266k Ld	Slack Low	Calm	0ft	Day Clr	3 X 75T BP	None
Comments: Familiarization scenario for pilots to acquaint themselves with the simulator. Sand Island range was enlarged and brightened in the simulation because it was difficult to see in the simulator.									
2	Bar	In	266k Ld	Base Flood	SW 25	7ft	Day Clr	2 X 75T BP	None
Comments: Bar crossing scenario. Wind and waves caused vessel to turn to starboard. Hard port rudder and half to full ahead required to maintain course off Buoy 12. Simulated aborting approach off Buoy 14 using tug tethered on stern and Tug on starboard bow.									
3	Bar	In	266k Ld	Base Ebb	SW 25	20ft	Day Clr	None	None
Comments: Bar crossing scenario. Wind and waves caused vessel to turn to starboard. Needed full ahead at Buoy 6 and lost steering control at Buoy 8.									
4	Bar	In	266k Ld	Base Ebb	SW 25	20ft	Day Clr	None	None
Comments: Bar crossing scenario. Started off at half ahead (10.7 knots) and reduced to slow ahead at start. Could not steer ship in simulated wind and wave conditions. Regained control of the vessel after changing the direction of waves to 280T and reduced wave height from 20ft to 17ft.									
5	Bar	In	266k Ld	Base Ebb	SW 25	Zones	Day Clr	None	None
Comments: Bar crossing scenario. Defined wave zones to better simulate bar conditions based on CRB pilot input. Outside zone waves - 225T X 16ft, Mid zone waves - 250 X 16ft, Outer River zone - 290T X 10ft, River Approach zone - 310T X 6ft. (Used the wave zones for all subsequent Bar Crossing simulations). Ship could be controlled using 20 to 30 degrees of rudder and half ahead with the occasional kick to full ahead.									
6	Bar	Out	266k Bl	Base Ebb	S 25	Zones	Day Clr	None	None
Comments: Bar crossing scenario. Ship started and kept at half ahead throughout scenario. Controllable but needed 20 to 30 degrees of rudder to maintain control.									
7	Bar	Out	266k Bl	Base Ebb	S 25	Zones	Day Clr	None	None
Comments: Bar crossing scenario. Ship started and kept at full ahead maneuvering throughout scenario. Easier to control vessel at full ahead on departure.									

Continued on next page

Simulation Runs Table Continued

No.	Area	In Out	Ship	Current Tide	Winds	Waves	Visibility	Tugs Used	Emergencies
8	Bar	In	216k Ld	Base Flood	SW 25	Zones	Day Clr	None	None
Comments: Bar crossing scenario. Ship started at full sea speed and required approximately 10 degrees of port rudder to maintain course. Slowed to full ahead maneuvering between Buoy 10 and 12. Ship controllable throughout, but ship's speed over the ground maintained at over 14 knots.									
9	Bar	In	266k Ld	Base Ebb	SW 25	Zones	Day Clr	None	None
Comments: Bar crossing scenario. Ship started at full ahead. Ship controllable throughout, with ship's speed maintained at an average of 13.5 knots. Slowed down effectively at Buoy 14 and used kicks ahead on the engines to maintain heading.									
10	Bar	Out	266k Ld	Base Flood	SW 25	Zones 25ft	Day Clr	None	None
Comments: Bar crossing scenario. Increased Outer wave zones to 25ft to simulate maximum outbound bar crossing conditions. The ship was marginally controllable at full sea speed.									
11	Bar	Out	140k Bl	Base Flood	SW 25	Zones 25ft	Day Clr	None	None
Comments: Bar crossing scenario. Increased Outer wave zones to 25ft to simulate maximum outbound bar crossing conditions. The ship was controllable at full sea speed.									
12	River	In	266k Ld	Base Flood	SW 25	0ft	Day Clr	2 X 75T BP	None
Comments: River Transit scenario. Ship started at half ahead (10.7knots STW). Tug tethered on stern at Buoy 14. Second tug made up on starboard shoulder at Buoy 12. Stern tug backing easy at Buoy 12. Reasonable control of ship with occasional hard to port rudder. Slow ahead at Point Adams. Third tug made up on port shoulder at Hammond with ship down to 7 knots.									
13	All	In	266k Ld	Slack Low	Calm	0ft	Day Clr	None	None
Comments: Shiphandling trial with 266K Ld LNG model. Opportunity for the pilots to get a feel for the ship's maneuvering characteristics on approach and in vicinity of the terminal, no wind or current.									
14	Terminal	In	266k Ld	Base Flood	SW 10	0ft	Day Clr	3 X 75T BP	None
Comments: Starboard side alongside docking with tugs. Ship ran aground on initial approach due to depth error in basin, but heading and speed under control for docking. Corrected error and resumed approach for port side alongside docking. Completed docking under control.									

Continued on next page

Simulation Runs Table Continued

No.	Area	In Out	Ship	Current Tide	Winds	Waves	Visibility	Tugs Used	Emergencies
15	River	In	140k Ld	Base Flood	SW 30	0ft	Day Clr	1 X 75T BP	None
Comments: Half ahead start. Tug tethered on stern before Buoy 14. Increased wind speed to SW 30 knots. Good control of speed and heading maintained using after tug.									
16	River	In	140k Ld	Base Flood	SW 30	0ft	Day Clr	None	None
Comments: Half ahead start. No tug assistance. Increased wind speed to SW 30 knots. Hard to port not holding heading. Needed kick full ahead at Buoy 20. Marginal control at Buoy 20. Stopped simulation.									
17	River	In	140k Ld	Base Flood	SW 30	0ft	Day Clr	None	None
Comments: Full ahead start. No tug assistance. Increased wind speed to SW 30 knots. Had to maintain full ahead to maintain control of heading around Buoy 14. Managed to slow down to 10 knots through the water by Point Adams. Three tugs made up off Hammond and docked port side alongside terminal.									
18	River	In	216k Ld	Base Flood	SW 30	0ft	Day Clr	3 X 75T BP	None
Comments: Half ahead start. Tug tethered on stern before Buoy 12. Increased wind speed to SW 30 knots. Good control of speed and heading maintained using after tug. Additional tugs made up on starboard bow and port quarter at Point Adams. Speed down to 4 knots at Hammond.									
19	Terminal	Out	140k Bl	Base Flood	SW 20	0ft	Day Clr	3 X 75T BP	None
Comments: Undocking from starboard side alongside. Uneventful undocking maneuver and turning ship in basin to line up for departure.									
20	Terminal	Out	266k Bl	Base Flood	SW 20	0ft	Day Clr	3 X 75T BP	None
Comments: Undocking from starboard side alongside. Took longer than with the 140k Ld ship but controllable throughout maneuver.									
21	Terminal	Out	140k Bl	Base Flood	NW 25	0ft	Day Clr	3 X 75T BP	None
Comments: Undocking from starboard side alongside. Took longer than with the 140k Ld ship but controllable throughout maneuver.									

Continued on next page

Simulation Runs Table Continued

No.	Area	In Out	Ship	Current Tide	Winds	Waves	Visibility	Tugs Used	Emergencies
22	Terminal	Out	266k Bl	Base Ebb	NW 25	0ft	Day Clr	3 X 75T BP	None
Comments: Undocking from starboard side alongside. Uneventful undocking maneuver.									
23	Terminal	Out	266k Bl	Base Flood	NW 25	0ft	Day Clr	3 X 75T BP	None
Comments: Undocking from port side alongside. Uneventful undocking maneuver.									
24	Terminal	Out	266k Bl	Base Ebb	NW 25	0ft	Day Clr	3 X 75T BP	None
Comments: Undocking from port side alongside. Uneventful undocking maneuver.									
25	Terminal	In	266k Ld	Base Ebb	SW 25	0ft	Day Clr	3 X 75T BP	None
Comments: Starboard side docking. Slow progress going alongside due to SW wind, but more tug power was available to overcome wind force.									
26	Terminal	In	266k Ld	Base Flood	NW 25	0ft	Day Clr	3 X 75T BP	None
Comments: Starboard side docking. First attempt ship slowed down too early; ship drifted south and grounded in shallows west of the turning basin. Second attempt ship approached from a more northerly position with a faster approach speed. Stopped vessel off the dock and allowed the wind and current to bring the ship laterally towards the dock under control.									
27	Terminal	Out	266k Ld	Moderate Ebb	NW 25	0ft	Day Clr	3 X 75T BP	None
Comments: Undocking from starboard side alongside. Successful maneuver but used all three tugs at full power and bow thruster to get off and make turn.									
28	Terminal	Out	266k Ld	Moderate Ebb	NW 25	0ft	Day Clr	3 X 75T BP	None
Comments: Undocking from port side alongside. Successful maneuver using moderate tug power.									

Continued on next page

Simulation Runs Table Continued

No.	Area	In Out	Ship	Current Tide	Winds	Waves	Visibility	Tugs Used	Emergencies
29	Terminal	Out	266k Ld	Max Ebb	NW 10	0ft	Day Clr	3 X 75T BP	None
Comments: Undocking from starboard side alongside. Successful maneuver using moderate tug power, thruster and ship's engines.									
30	Terminal	Out	266k Ld	Max Ebb	NW 10	0ft	Day Clr	3 X 75T BP	None
Comments: Undocking from port side alongside. Successful maneuver but slower than undocking in same conditions starboard side alongside.									
31	Terminal	In	266k Ld	Max Flood	NW 10	0ft	Day Clr	3 X 75T BP	None
Comments: Starboard side alongside docking controllable using tugs and ship's propulsion systems. Could stop ship with 1.5 knots of lateral motion caused by wind and current.									
32	Terminal	In	266k Ld	Max Flood	NW 10	0ft	Day Clr	3 X 75T BP	None
Comments: Port side alongside docking was difficult to control ship. The relative angle of current caused the bow of the ship to set down onto the dock. Two tugs working full power on the bow and the bow thruster at full could not stop the bow's lateral motion of more than one knot.									
33	River	In	266k Ld	Base Flood	SW25	0ft	Day Clr	2 X 75T BP	Rudder System Failure
Comments: Started at half ahead with one tug tethered on stern, bow tug escorting free on the bow. Hard starboard rudder failure north north east of Buoy 16. Controlled vessel using stern tug and then dropped anchor to facilitate 180 degree turn off Buoy 14. Bow tug working free on the bow.									
34	River	In	266k Ld	Base Flood	SW25	0ft	Day Clr	2 X 75T BP	Rudder System Failure
Comments: Started at slow ahead with one tug tethered on stern, bow tug escorting free on the bow. Used tug on the stern to make a tighter more controlled turn around Buoy 12. Continued to use tug on stern to control tendency to turn to starboard due to wind. Hard to starboard rudder failure at Buoy 21. Controlled vessel with stern tug and maintained transit with assistance from the bow tug made up through the bullnose.									
35	Terminal	At Dock	266k Ld	Base Ebb	NW 25	0ft	Day Clr	2 X 75T BP Standing by in Turning Basin	Outbound container ship loses steering
Comments: 35,000 displacement container ship outbound at 10 knots over the ground. Two tugs standing by in turning basin. Hard port rudder failure between Buoy 31 and 33. Tug assistance requested. Container ship did not respond dramatically to hard port rudder failure because port 20 rudder was required to compensate for the strong NW wind. Ship did not veer into LNG terminal turning basin.									

Continued on next page

Simulation Runs Table Continued

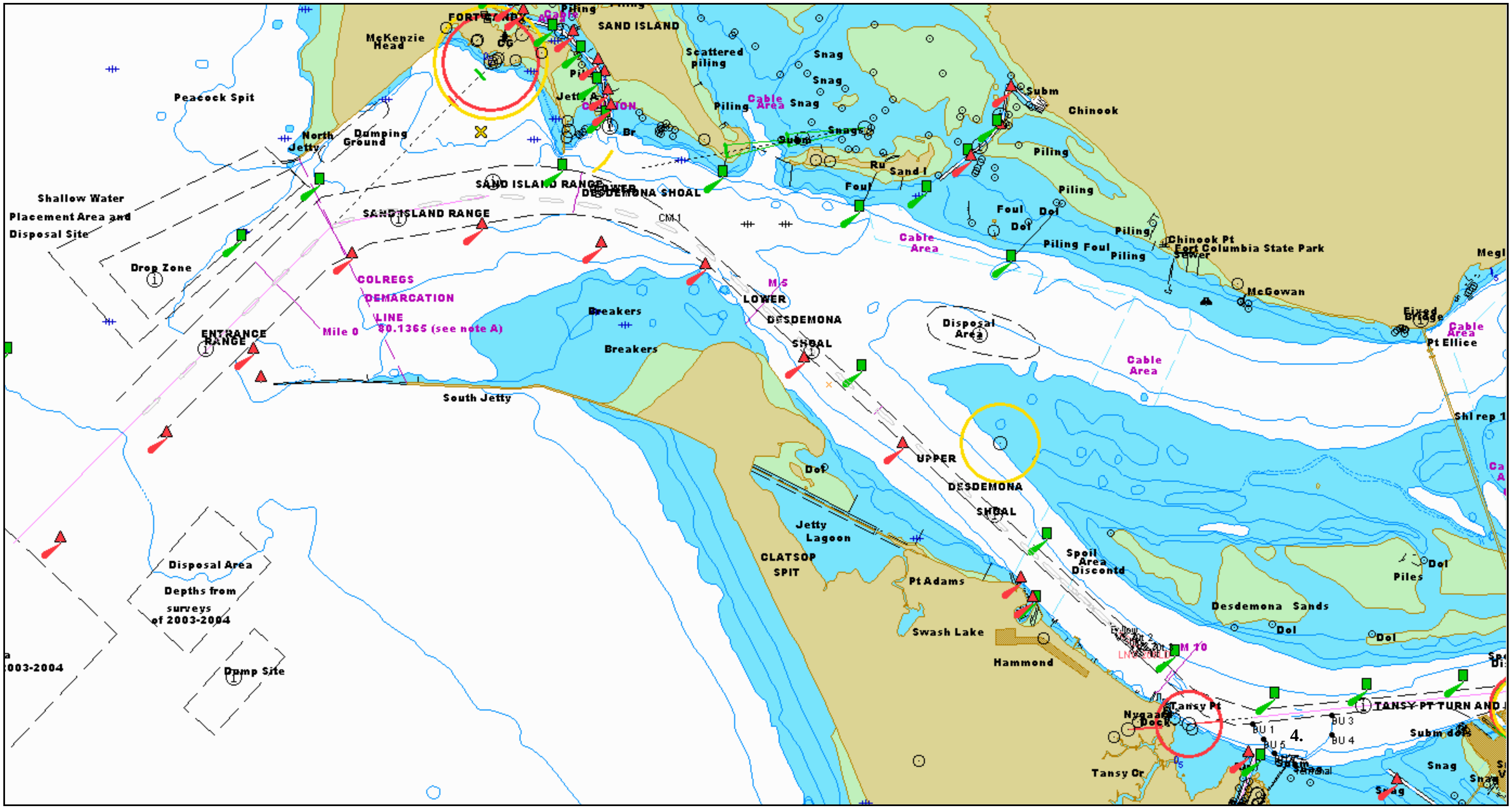
No.	Area	In Out	Ship	Current Tide	Winds	Waves	Visibility	Tugs Used	Emergencies
36	Terminal	At Dock	266k Ld	Base Ebb	SW 25	0ft	Day Clr	2 X 75T BP Standing by in Turning Basin	Outbound container ship loses steering
Comments: 35,000 displacement container ship outbound at 10 knots over the ground. Two tugs standing by in turning basin. Hard port rudder failure at Buoy 31. Tug assistance requested. Container ship did not respond dramatically to hard port rudder failure because engine was put astern and transverse thrust counteracted the swing to port caused by the hard port rudder failure. Ship did not veer into LNG terminal turning basin.									
37	Terminal	At Dock	266k Ld	Base Ebb	SW 25	0ft	Day Clr	2 X 75T BP Standing by in Turning Basin	Outbound container ship loses steering and propulsion
Comments: 35,000 displacement container ship outbound at 10 knots over the ground. Two tugs standing by in turning basin. Hard port rudder failure and loss of propulsion at Buoy 31. Tug assistance requested. Container ship entered into LNG terminal turning basin, but the ship was controlled using anchors and tugs before it struck the LNG ship at the terminal.									
38	Terminal	At Dock	266k Ld	Base Flood	SW 25	0ft	Day Clr	2 X 75T BP Standing by in Turning Basin	Inbound Bulk Carrier loses steering and propulsion.
Comments: Bulk carrier inbound. Two tugs standing by in turning basin. Hard starboard rudder failure in the Tansy Point turn. Ship ran aground in the shallows while entering the LNG Terminal turning basin.									
39	Terminal	At Dock	266k Ld	Base Flood	SW 25	0ft	Day Clr	2 X 75T BP	Outbound container ship loses steering
Comments: Bulk carrier inbound. Two tugs standing by in turning basin. Pilot to adjust courses for worst case scenario rudder and engine failure. Hard starboard rudder failure and loss of propulsion occured near Buoy 29. Tug assistance requested. Tugs unable to control bulk carrier before it struck LNG Ship docked at the terminal.									
40	Terminal	At Dock	266k Ld	Base Flood	SW 25	0ft	Day Clr	2 X 75T BP	Outbound container ship loses steering
Comments: Bulk carrier inbound. One tug standing by inbound ship, other tug standing by in Turning Basin. Pilot to adjust courses for worst case scenario rudder and engine failure. Hard starboard rudder failure and loss of propulsion occur near Buoy 29. Tug was able to apply forces quickly when failure occurred and controlled vessel.									

Simulation 1

Objective	Pilots familiarize themselves with the simulator.
Description	Inbound Ship type: LNG 266 LD Start Position: Buoy 2 Start course and speed: 045T X 11 knots Current: None Tide: Lower Low Water Wind: Calm Waves: 0ft Tug forces used: None
Significant Events	None.
Conclusions	Sand Island range enlarged and brightened in the simulation because it was difficult to see in the simulator.

Continued on next page

Simulation 1 Continued



Simulation 2

Objective

Establish operational parameters for crossing the Columbia River Bar.

Description

Inbound
Ship type: LNG 266 LD
Start Position: Buoy 2
Start course and speed: 045T X 11 knots
Current: Base Flood
Tide: Lower Low Water
Wind: SW 25 knots
Waves: SW 7ft
Tug forces used: None

Significant Events

14:15 Difficulty steering vessel from Buoy 8 to Buoy 12. Required frequent hard port rudder and kicks ahead on the engine to maintain heading.

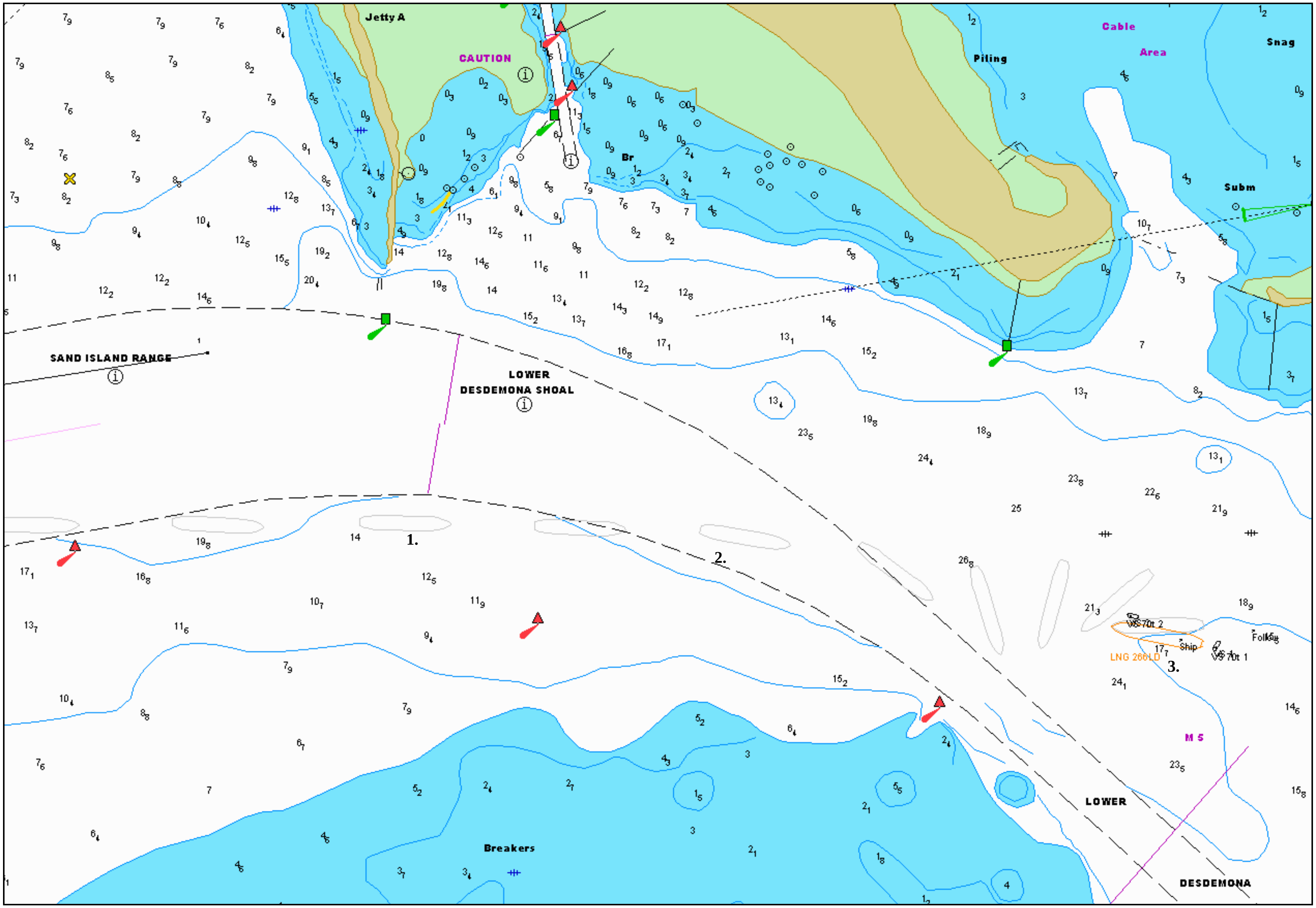
1. 14:24 Difficulty steering vessel using hard port rudder and half ahead.
2. 14:26 Pilot decided to attempt abort maneuver with two tugs assisting.
3. 14:39 Completed turn to starboard and heading outbound.

Conclusions

Wind and waves caused vessel to turn to starboard. Hard port rudder and half to full ahead required to maintain course between Buoy 8 and Buoy 12. Simulated abort maneuver off Buoy 14 using tug tethered on stern and tug on starboard bow. Considered unsafe to enter river portion because of steering difficulties, but successful abort maneuver completed.

Continued on next page

Simulation 2 Continued



Simulation 3

Objective

Establish operational parameters for crossing the Columbia River Bar.

Description

Inbound
Ship type: LNG 266 LD
Start Position: Buoy 2
Start course and speed: 045T X 11 knots
Current: Base Ebb
Tide: Lower Low Water
Wind: SW 25 knots
Waves: SW 20ft
Tug forces used: None

Significant Events

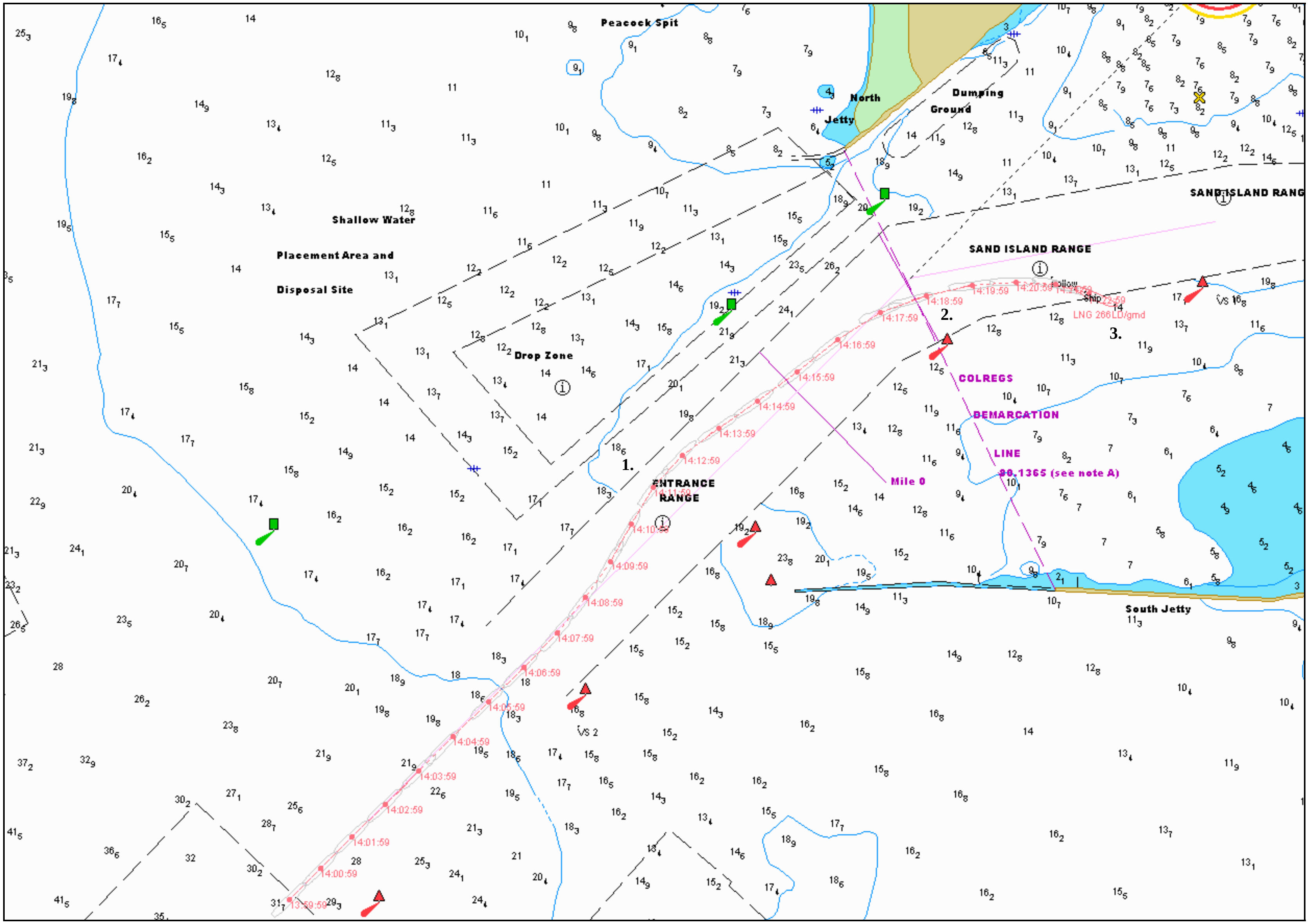
1. 14:07 Difficulty steering vessel between Buoy 4 and Buoy 8.
2. 14:18 Could not steer vessel after passing Buoy 8, even with maximum rudder and both engines.
3. 14:23 Vessel ran aground between Buoy 8 and 10.

Conclusions

Wind and waves caused vessel to turn to starboard. After passing Buoy 8 the ship could not hold the desired course with wind and waves on the starboard quarter.

Continued on next page

Simulation 3 Continued



Simulation 4

Objective

Establish operational parameters for crossing the Columbia River Bar.

Description

Inbound
Ship type: LNG 266 LD
Start Position: Buoy 6
Start course and speed: 045T X 11 knots
Current: Base Ebb
Tide: Lower Low Water
Wind: SW 25 knots
Waves: SW 20ft
Tug forces used: None

Significant Events

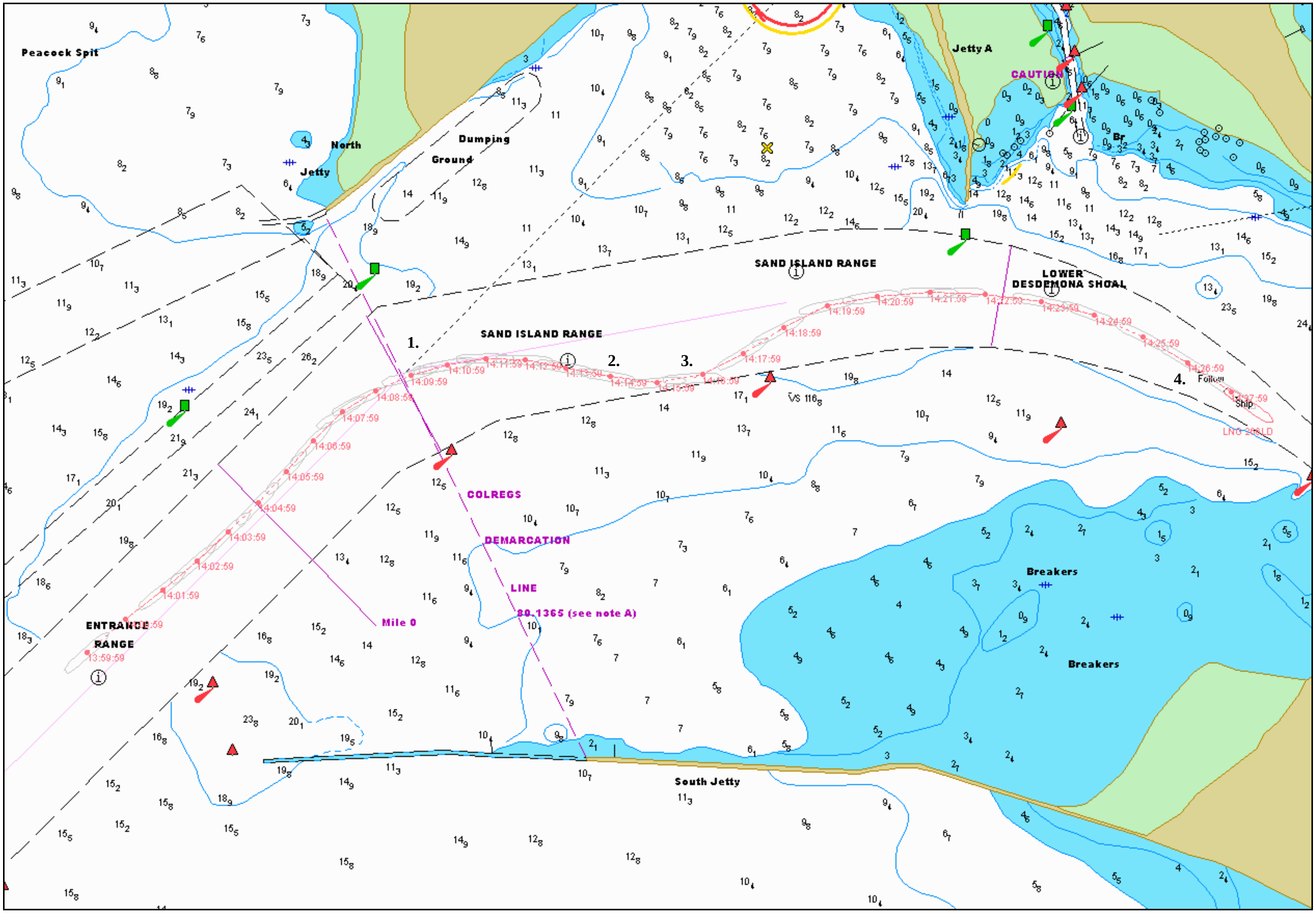
1. 14:09 Could not steer vessel after passing Buoy 8.
2. 14:15 Changed wave conditions to 16ft from 280T.
3. 14:16 Recovered control of vessel.
4. 14:27 Kept control of vessel in 16ft waves from 280T shifting to 300T between Buoys 12 and 14.

Conclusions

Wind and waves caused vessel to turn to starboard. After passing Buoy 8 the ship could not hold the desired course with wind and waves on the starboard quarter. Changed wave height and direction before ship could be controlled.

Continued on next page

Simulation 4 Continued

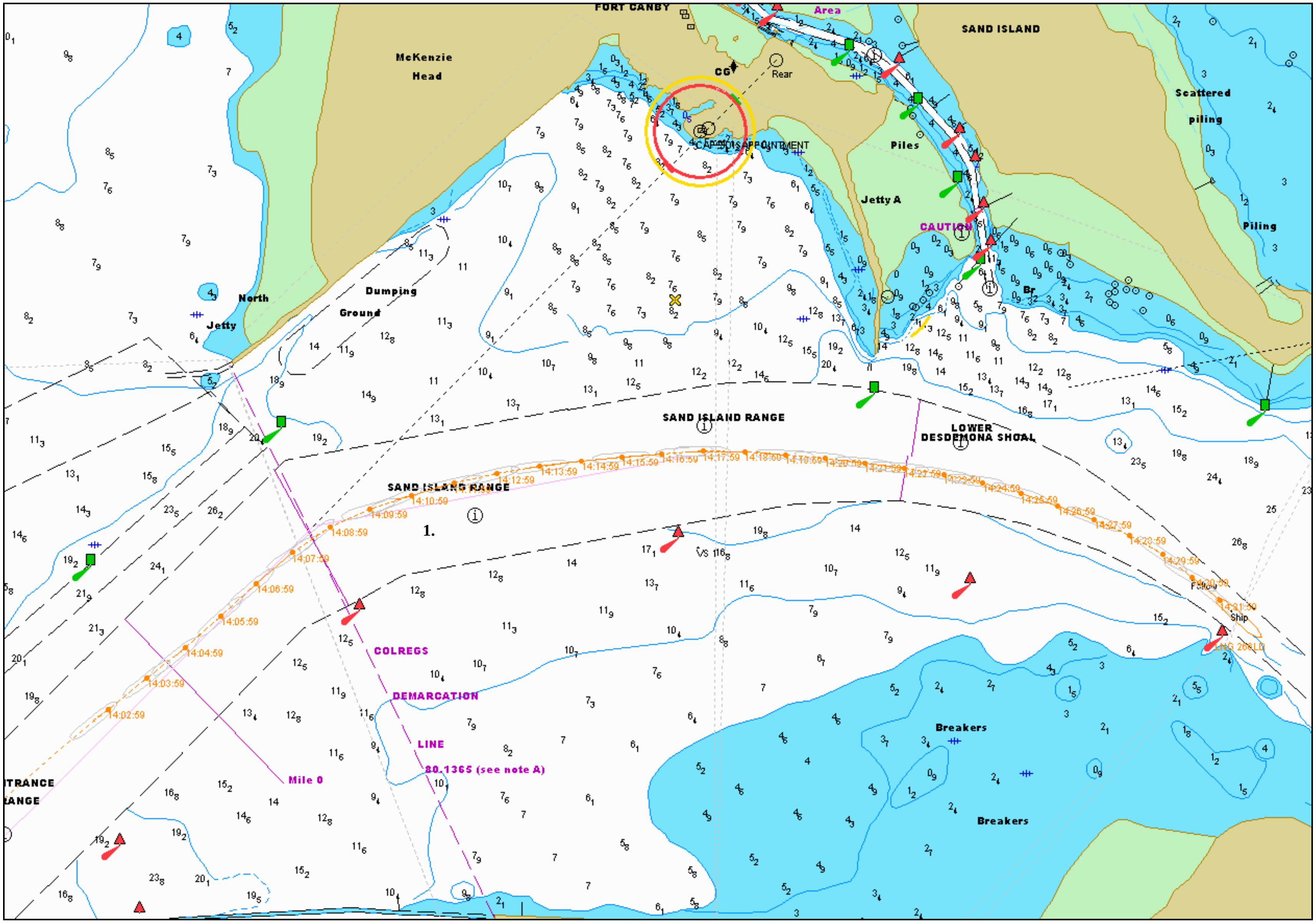


Simulation

Objective	Establish operational parameters for crossing the Columbia River Bar.
Description	Inbound Ship type: LNG 266 LD Start Position: Buoy 6 Start course and speed: 048T X 10 knots Current: Base Ebb Tide: Lower Low Water Wind: SW 25 knots Waves: Defined wave zones to better simulate Bar conditions based on CRB pilot input. Outside zone waves - 225T X 16ft, Mid zone waves - 250 X 16ft, Outer River zone - 290T X 10ft, River Approach zone - 310T X 6ft. (Used the wave zones for all subsequent Bar Crossing simulations). Tug forces used: None
Significant Events	1. 14:10 Hard to port rudder and kicks ahead on the engine required to control heading between Buoy 8 and 10.
Conclusions	Ship could be controlled using 20 to 30 degrees of rudder and half ahead with the occasional kick to full ahead. This simulation demonstrated the limits of environmental factors for this vessel crossing the Bar inbound.

Continued on next page

Simulation Continued

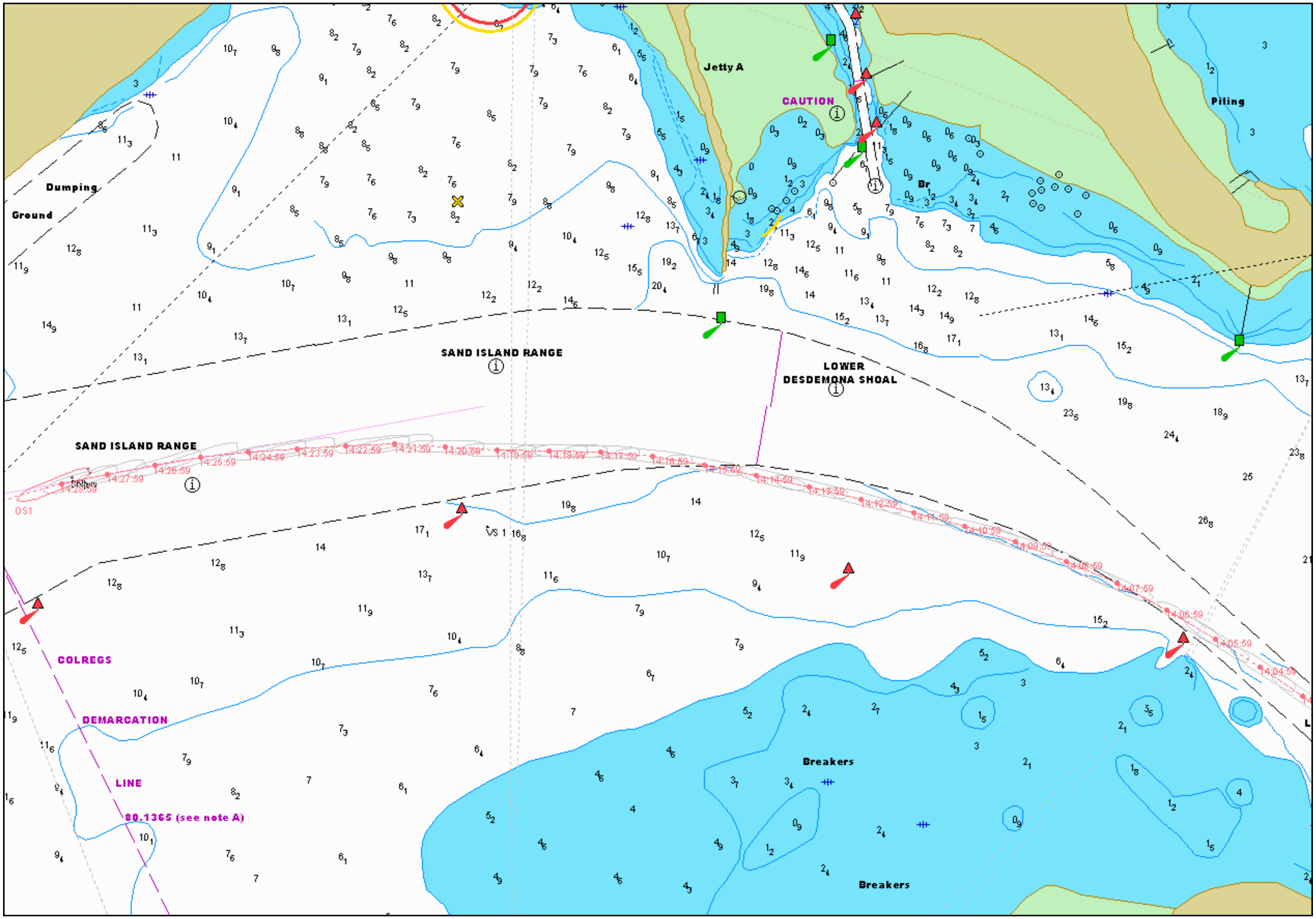


Simulation 6

Objective	Establish operational parameters for crossing the Columbia River Bar.
Description	Outbound Ship type: LNG 266 BL Start Position: Buoy 20 Start course and speed: 312T X 9 knots Current: Base Ebb Tide: Lower Low Water Wind: S 25 knots Waves: Defined wave zones. Tug forces used: None
Significant Events	None.
Conclusions	Maintained control of the vessel throughout at half ahead, but needed to use 20 and 30 degree rudder angles often.

Continued on next page

Simulation 6 Continued



Simulation 7

Objective

Establish operational parameters for crossing the Columbia River Bar.

Description

Outbound
Ship type: LNG 266 BL
Start Position: Buoy 20
Start course and speed: 312T X 13.6 knots
Current: Base Ebb
Tide: Lower Low Water
Wind: S 25 knots
Waves: Defined wave zones
Tug forces used: None

Significant Events

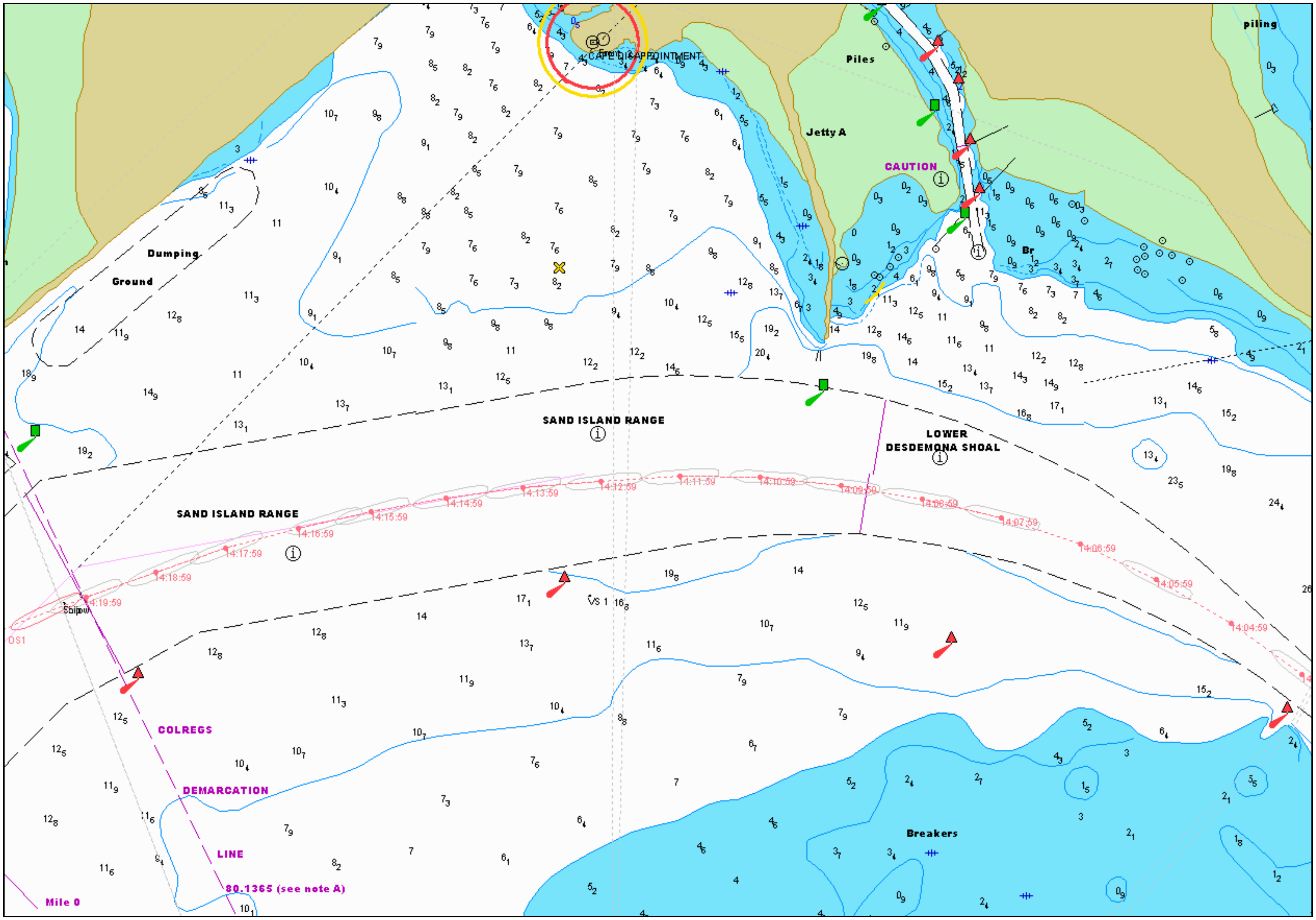
None.

Conclusions

Maintained control of the vessel throughout at full ahead. Much easier than in previous simulation using rudder angles up to 10 degrees.

Continued on next page

Simulation 7 Continued

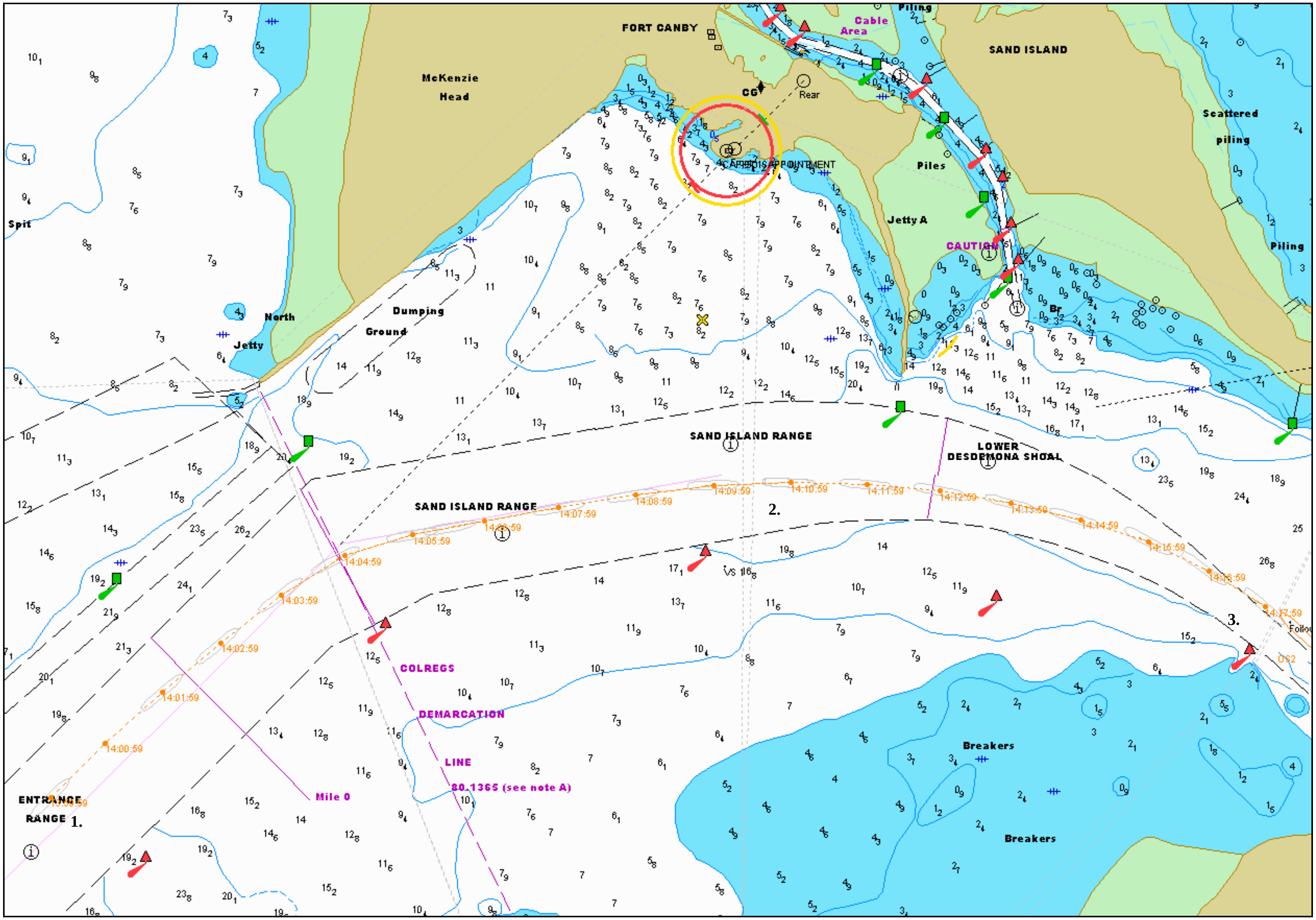


Simulation 8

Objective	Establish operational parameters for crossing the Columbia River Bar.
Description	Inbound Ship type: LNG 216 LD Start Position: Buoy 6 Start course and speed: 045T X 14.8 knots Current: Base Flood Tide: Lower Low Water Wind: SW 25 knots Waves: Defined wave zones. Tug forces used: None
Significant Events	1. 14:00 Starting off at full sea speed and maintained approximately 15.5 knots. 2. 14:10 Slowed to full ahead maneuvering speed. 3. 14:18 Maintained full ahead maneuvering speed until Buoy 14. Vessel down to 12.6 knots.
Conclusions	Vessel controllable all the way in with ship speed averaging 14 knots.

Continued on next page

Simulation 8 Continued

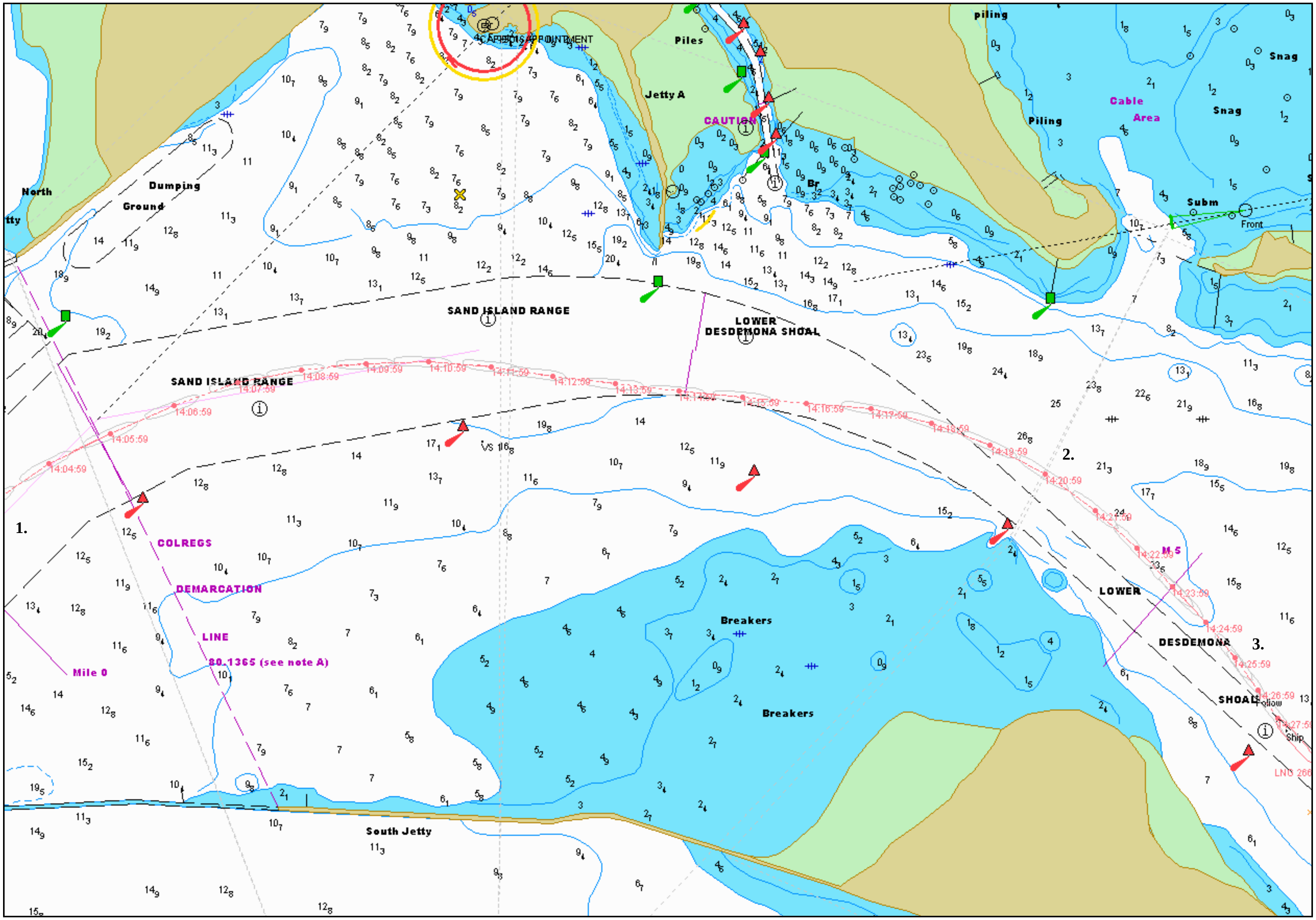


Simulation

Objective	Establish operational parameters for crossing the Columbia River Bar.
Description	Inbound Ship type: LNG 266 LD Start Position: Buoy 6 Start course and speed: 045T X 14.8 knots Current: Base Ebb Tide: Lower Low Water Wind: SW 25 knots Waves: Defined wave zones. Tug forces used: None
Significant Events	1. 14:00 Starting off at full sea speed and maintained approximately 12.5 knots. 2. 14:21 Reduced to slow ahead. 3. 14:18 Slowed down to less than 10 knots through the water by Buoy 20.
Conclusions	Vessel controllable all the way in with ship speed averaging 12 knots. Slowed vessel enough by Buoy 20 to make up and use tugs.

Continued on next page

Simulation Continued



Simulation 1

Objective

Establish operational parameters for crossing the Columbia River Bar.

Description

Outbound
Ship type: LNG 266 LD
Start Position: Buoy 20
Start course and speed: 312T X 12.8 knots
Current: Base Flood
Tide: Lower Low Water
Wind: SW 25 knots
Waves: Defined wave zones. Plus 25ft outer zone.
Tug forces used: None

Significant Events

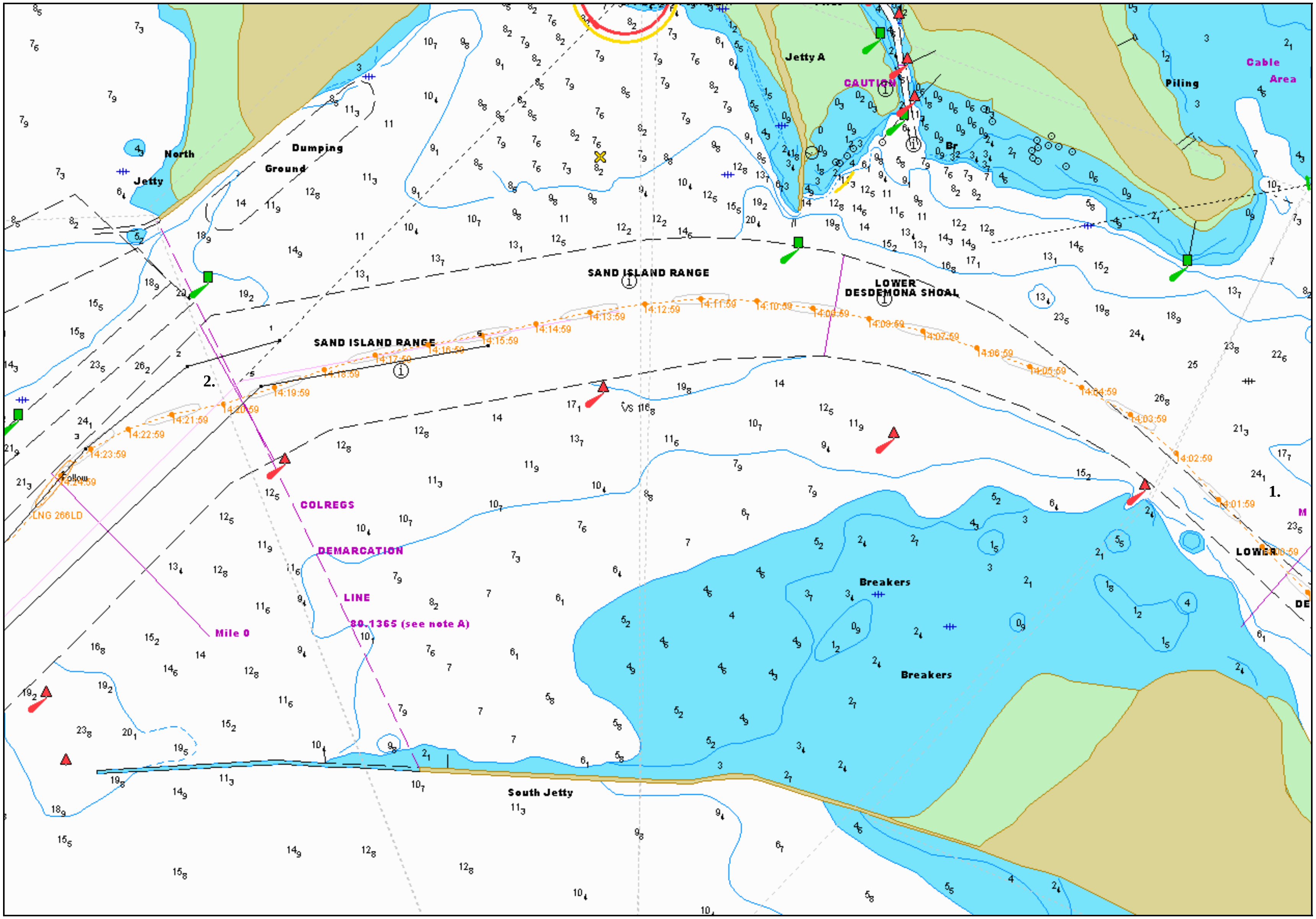
1. 14:00 Starting off at full sea speed.
2. 14:21 Entering 25ft wave zone. Difficulty steering with hard over rudder required often.

Conclusions

Vessel controllable at full sea speed until entering the 25ft wave zone where the vessel became difficult to control.

Continued on next page

Simulation 1 Continued

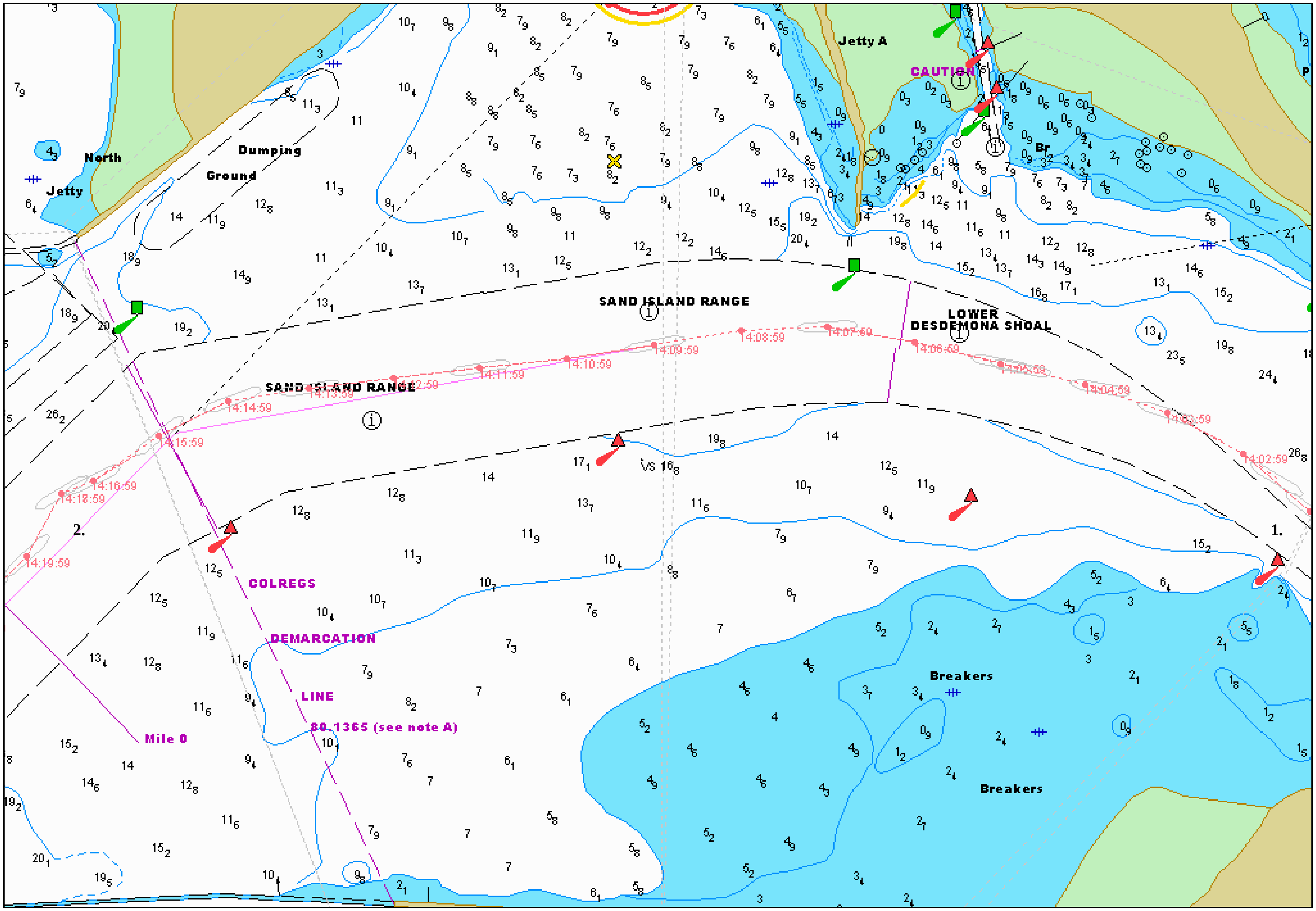


Simulation 11

Objective	Establish operational parameters for crossing the Columbia River Bar.
Description	Outbound Ship type: LNG 140 BL Start Position: Buoy 20 Start course and speed: 312T X 14.8 knots Current: Base Flood Tide: Lower Low Water Wind: SW 25 knots Waves: Defined wave zones. Plus 25ft outer zone. Tug forces used: None
Significant Events	1. 14:00 Starting off at full sea speed. 2. 14:18 Entering 25ft wave zone. Difficulty steering with hard over rudder required. Vessel ran aground due to wave height and Lower Low Water tide.
Conclusions	Vessel controllable at full sea speed until entering the 25ft wave zone where the vessel became difficult to control.

Continued on next page

Simulation 11 Continued



Simulation 12

Objective

Establish operational parameters for transiting between Buoy 14 and Tansy Point.

Description

Inbound
Ship type: LNG 266 LD
Start Position: Buoy 14
Start course and speed: 132T X 12.3 knots
Current: Base Flood
Tide: Lower Low Water
Wind: SW 25 knots
Waves: 0ft
Tug forces used: 3 X 75T BP

Significant Events

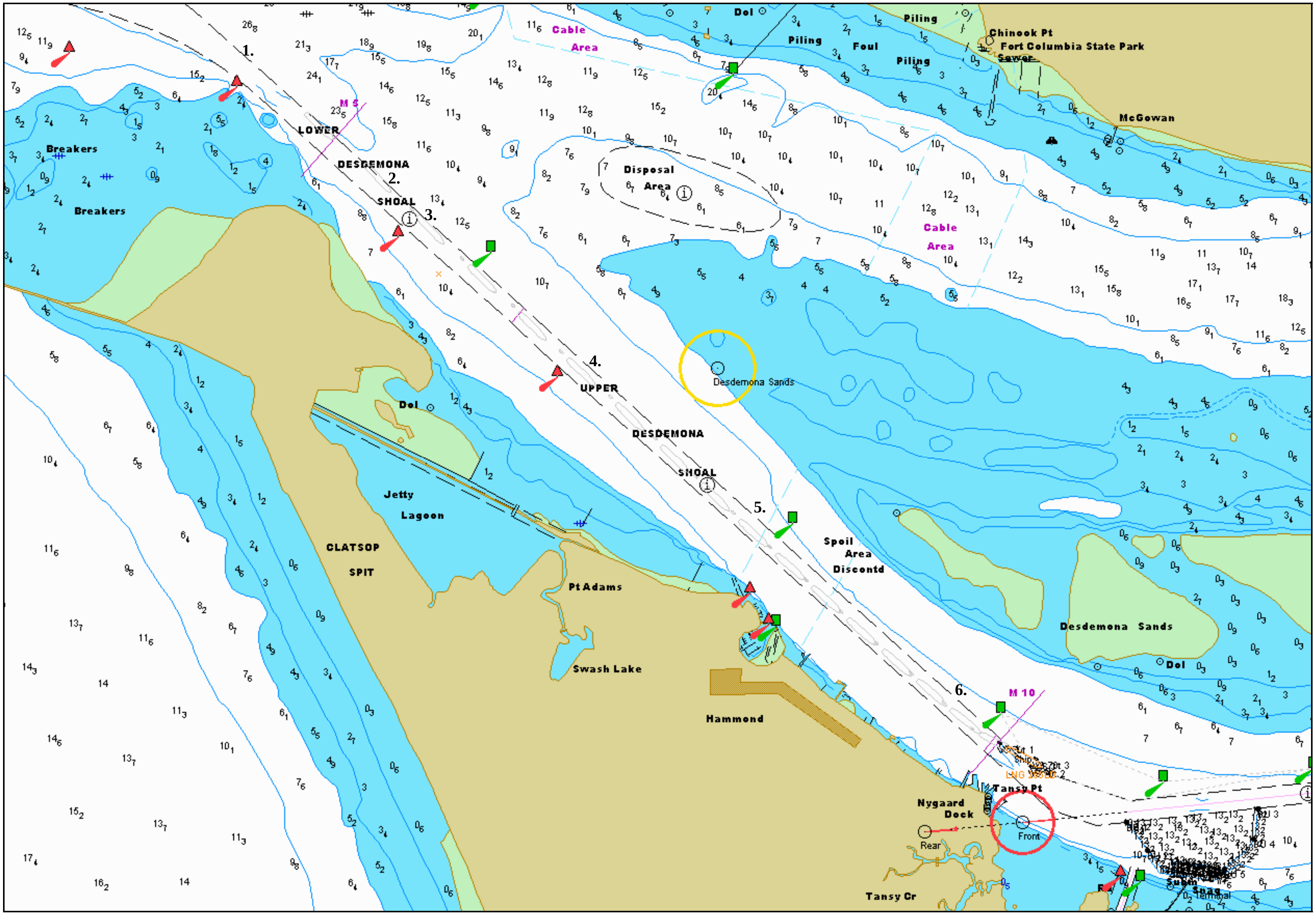
1. 16:00 Started off at half ahead, one tug tethered on the stern.
2. 16:05 Stern Tug pulling straight back easy (25 tons).
3. 16:06 Second tug made up on the starboard bow.
4. 16:13 Engines to slow ahead.
5. 16:19 Third tug made up on the port bow. Speed down to 7.4 knots.
6. 16:32 Engines to dead slow ahead. Speed down to 5.8 knots.

Conclusions

Vessel controllable throughout maneuver.
Use of tethered tug effective at controlling ship speed while maintaining higher engine revs for better steering response.

Continued on next page

Simulation 12 Continued



Simulation 13

Objective

Familiarize pilots with maneuverability of vessel without tug assistance.

Description

Inbound
Ship type: LNG 266 LD
Start Position: Hammond
Start course and speed: 133T X 7.6 knots
Current: None
Tide: Lower Low Water
Wind: Calm
Waves: 0ft
Tug forces used: None

Significant Events

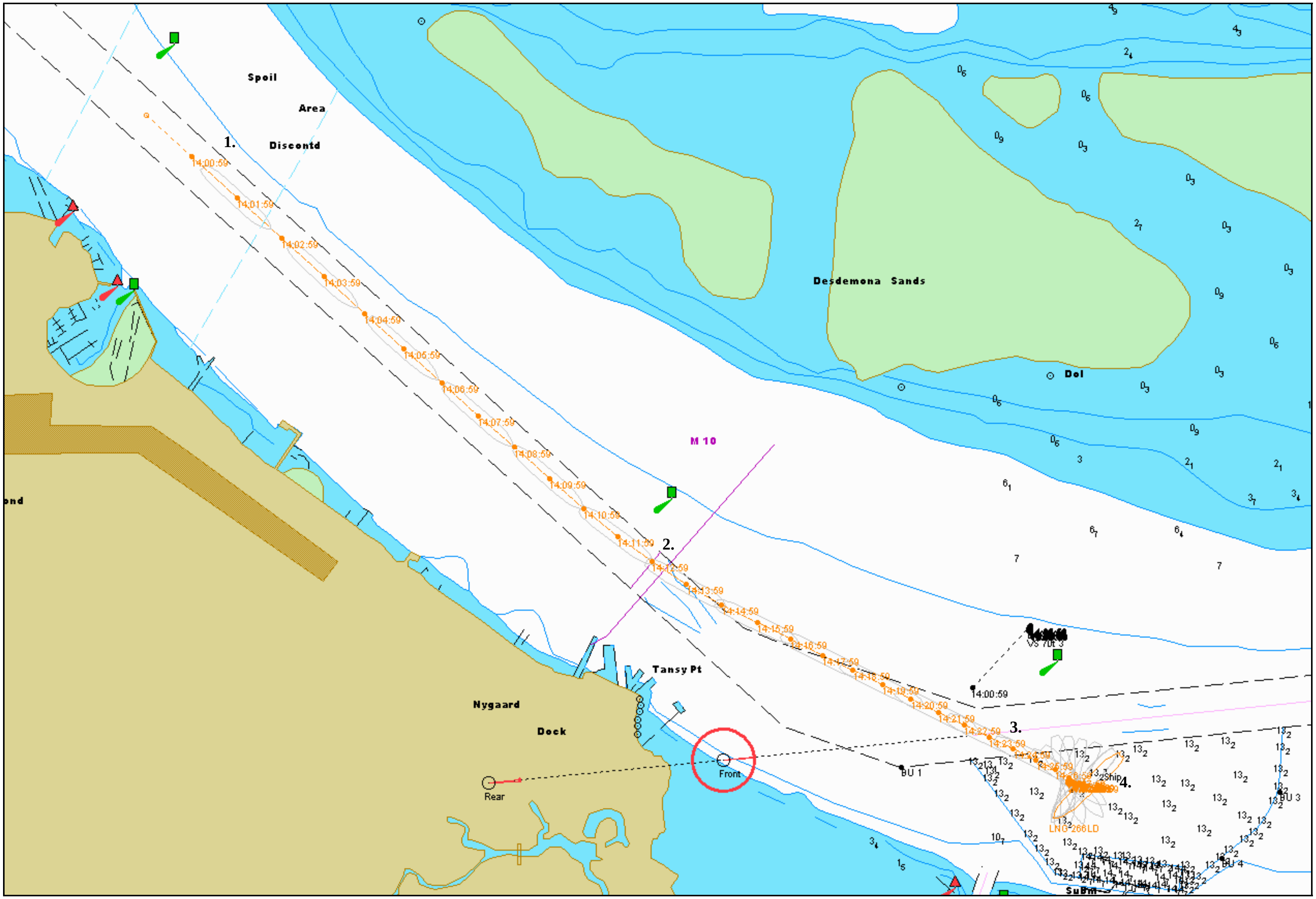
1. 14:00 Started off at slow ahead.
2. 14:15 Slowed to 5 knots.
3. 14:25 Slowed to 3.3 knots. Began rotation to starboard.
4. 14:40 Stopped exercise.

Conclusions

In no current or wind conditions the LNG 266 LD handles well, but slowly as would be expected of a ship with this power to size ratio.

Continued on next page

Simulation 13 Continued



Simulation 14

Objective

Establish operational parameters for approach and docking at the terminal.

Description

Inbound – Starboard side docking
Ship type: LNG 266 LD
Start Position: Hammond
Start course and speed: 132T X 8.8 knots
Current: Base Flood
Tide: Lower Low Water
Wind: SW 10
Waves: 0ft
Tug forces used: 3 X 75T BP

Significant Events

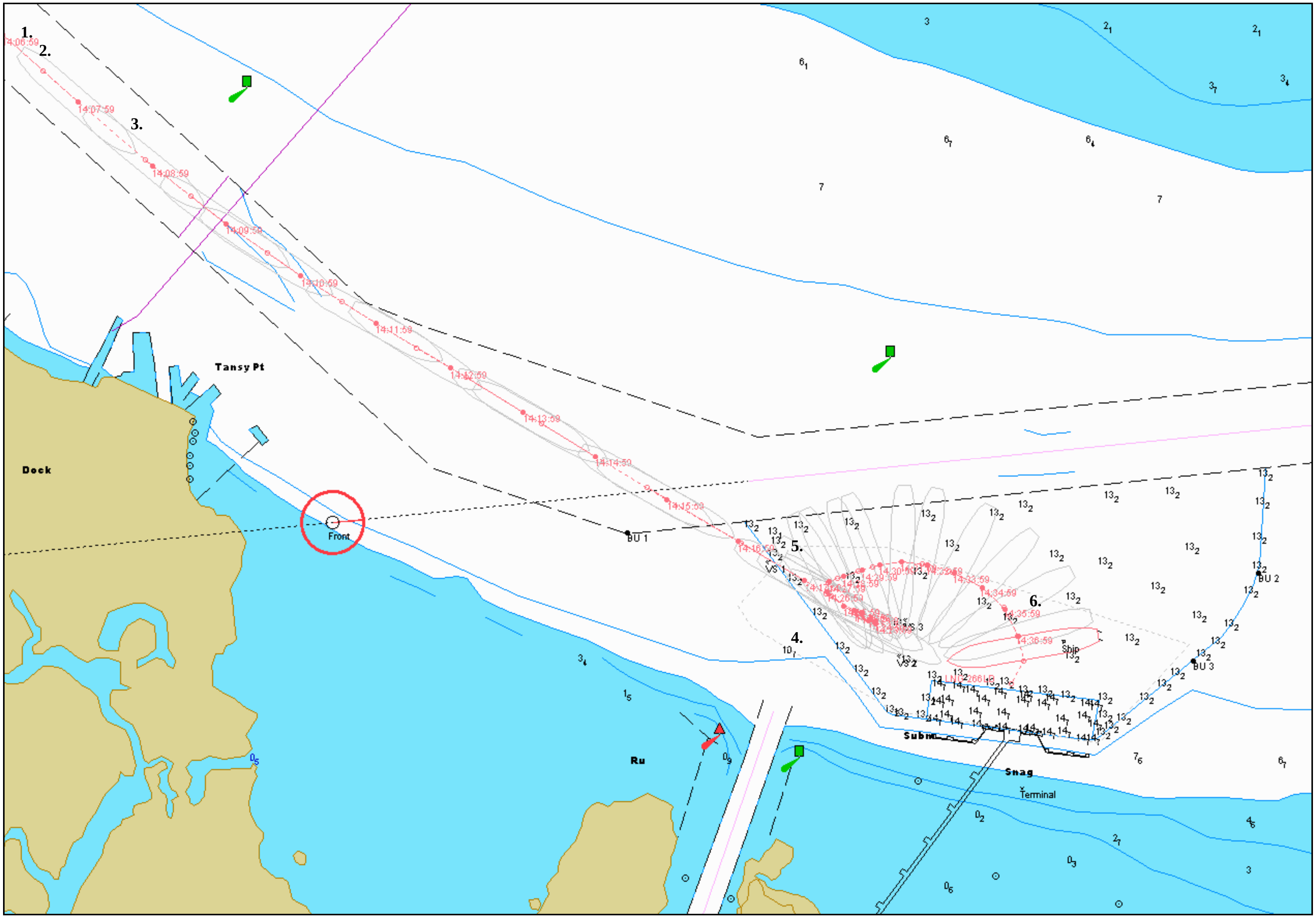
1. 14:00 Started off at slow ahead, tug tethered on stern.
2. 14:02 Second tug made up on the starboard bow. Ship speed 8.8 knots.
3. 14:07 Third tug made up on the port bow. Ship speed 7.5 knots.
4. 14:19 Vessel speed down to 3 knots. Ran aground due to simulation depth error.
5. 14:23 Repositioned vessel and began maneuver for port side alongside.
6. 14:40 Completed maneuver for port side alongside docking.

Conclusions

Vessel lined up well and speed under control for starboard side docking. Port side docking completed under control.

Continued on next page

Simulation 14 Continued



Simulation 1

Objective

Establish operational parameters for the turn between Buoys 12 and 20.

Description

Inbound
Ship type: LNG 140 LD
Start Position: Buoy 11
Start course and speed: 105T X 12.8 knots
Current: Base Flood
Tide: Lower Low Water
Wind: SW 25 knots increasing to SW 30 knots
Waves: 1ft
Tug forces used: 1 X 75T BP

Significant Events

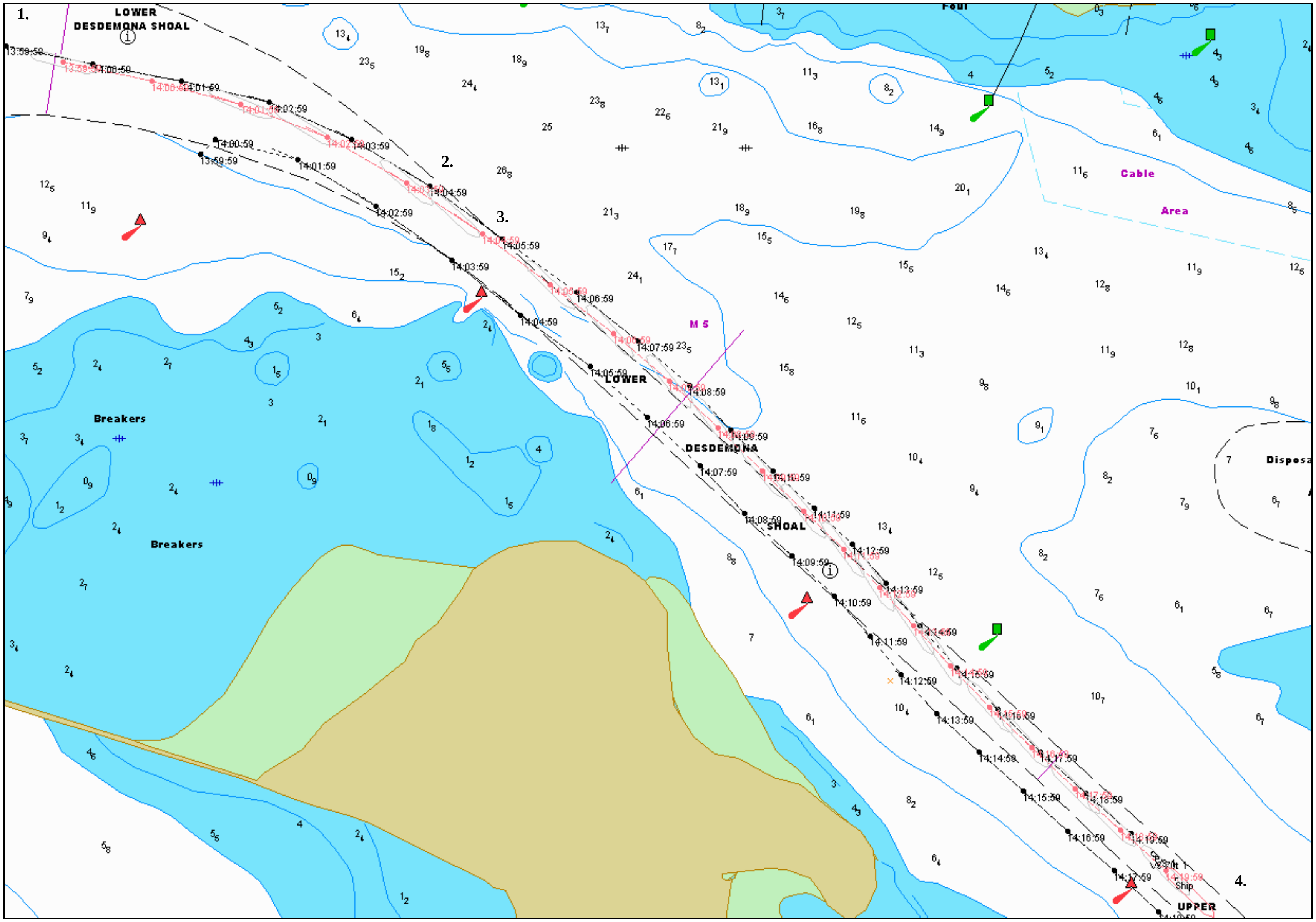
1. 14:00 Started off at slow ahead, tug tethered on stern.
2. 14:04 Increased winds to SW 30 knots.
3. 14:05 Engines to slow ahead, vessel speed 12.4 knots. Used tug on stern to help control heading and speed.
4. 14:20 Speed down to 8 knots.

Conclusions

Good control of speed and heading maintained by using stern tug.

Continued on next page

Simulation 1 Continued



Simulation 16

Objective

Establish operational parameters for the turn between Buoys 12 and 20.

Description

Inbound
Ship type: LNG 140 LD
Start Position: Buoy 11
Start course and speed: 105T X 12.8 knots
Current: Base Flood
Tide: Lower Low Water
Wind: SW 25 knots increasing to SW 30 knots
Waves: 1ft
Tug forces used: None

Significant Events

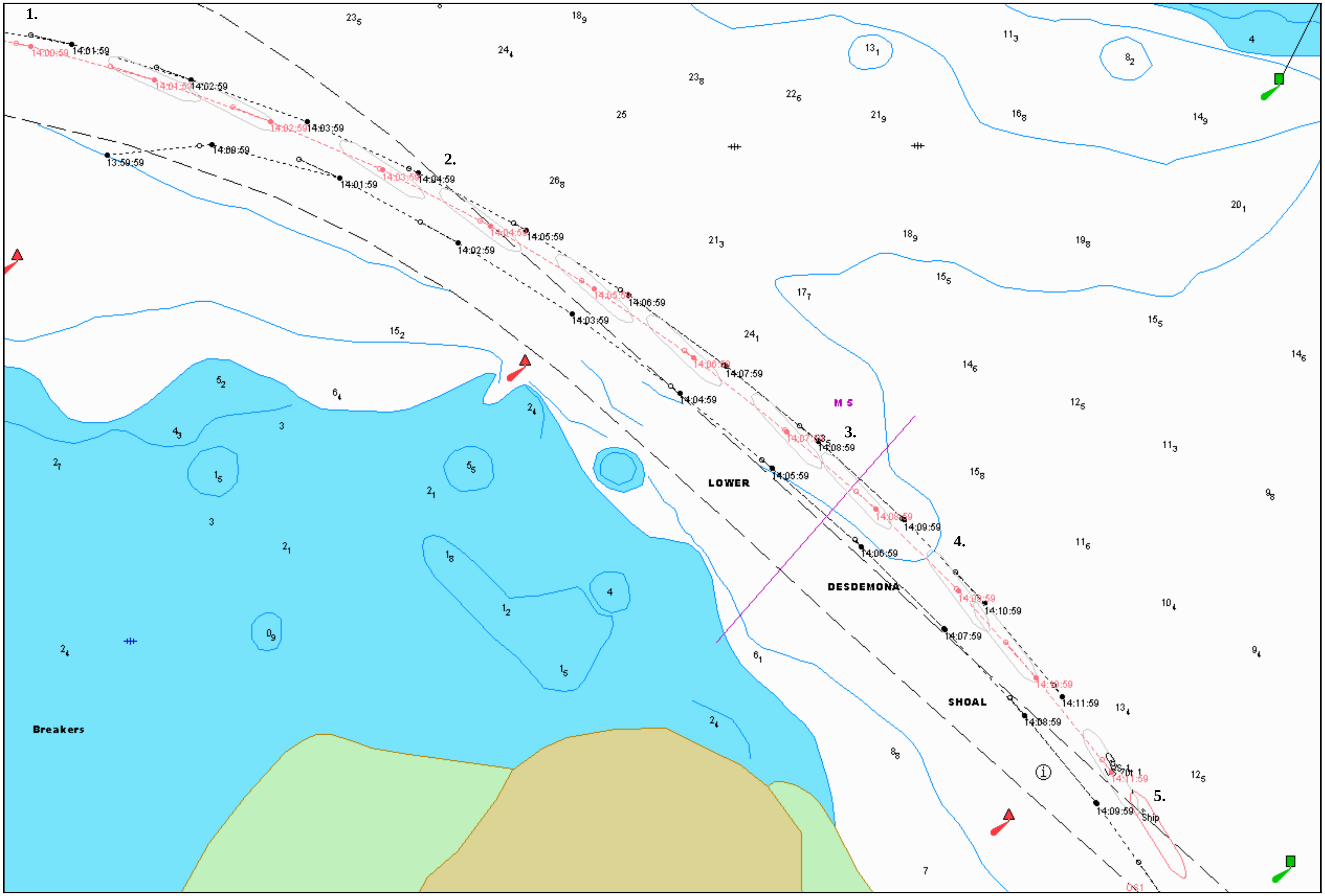
1. 14:00 Started off at slow ahead, tug tethered on stern.
2. 14:04 Increased winds to SW 30 knots.
3. 14:08 Wide turn 700 ft north east of the center of the channel.
4. 14:09 Rudder hard to port. Engine speed increased to full ahead.
5. 14:12 Simulation stopped, heading could not be controlled.

Conclusions

Poor control of speed and heading. Vessel's heading could not be controlled by Buoy 20.

Continued on next page

Simulation 16 Continued



Simulation 17

Objective

Establish operational parameters for the turn between Buoys 12 and 20.

Description

Inbound
Ship type: LNG 140 LD
Start Position: Buoy 11
Start course and speed: 105T X 16.2 knots
Current: Base Flood
Tide: Lower Low Water
Wind: SW 25 knots increasing to SW 30 knots
Waves: 1ft
Tug forces used: None

Significant Events

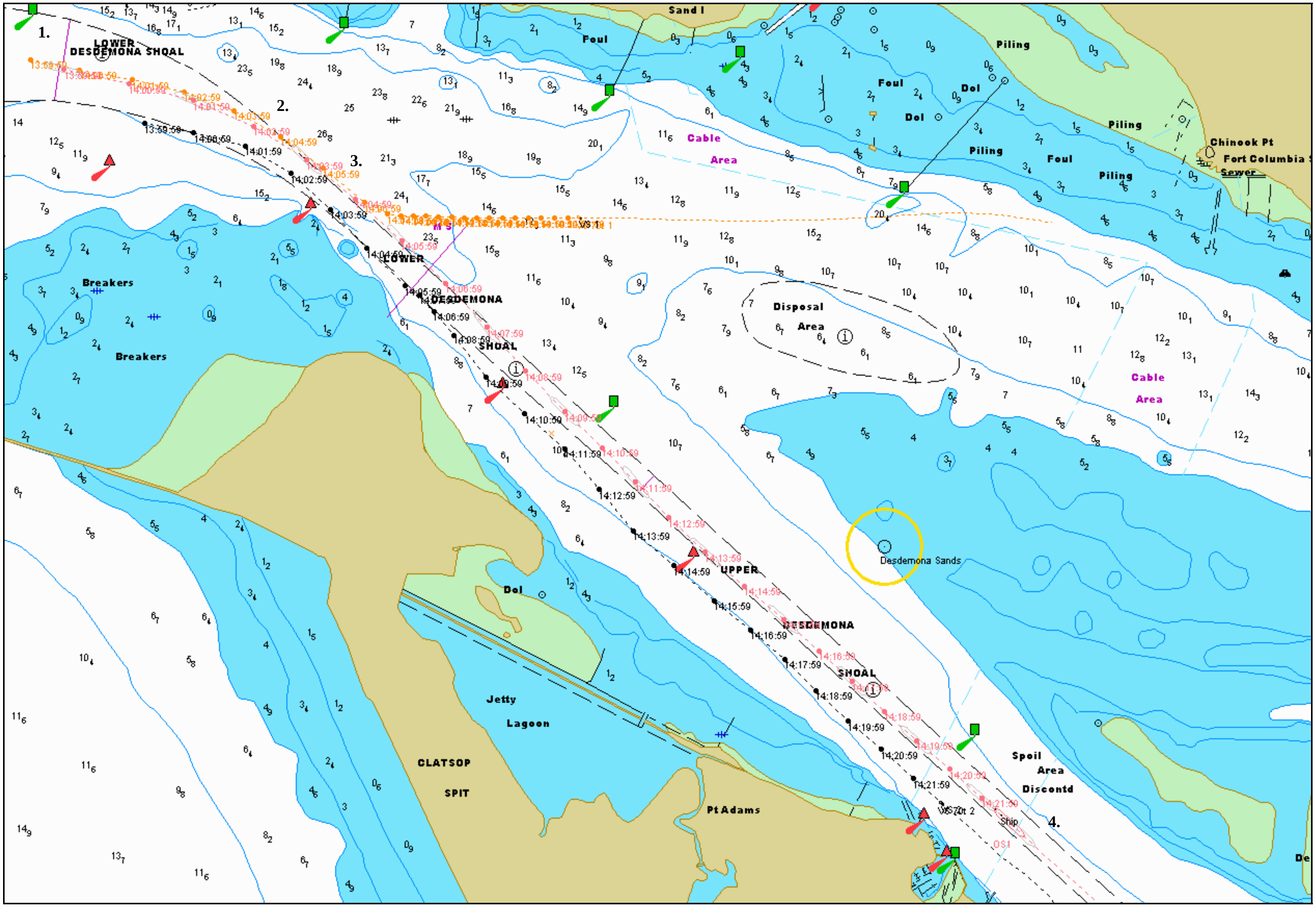
1. 14:00 Started off at full ahead.
2. 14:04 Increased winds to SW 30 knots.
3. 14:05 Maintained full ahead to control heading around Buoy 14. Ship speed 15 knots.
4. 14:22 Slowed down to 10 knots.

Conclusions

Full ahead required to make turn at Buoy 14. Managed to slow down to 10 knots by Hammond. Made tugs up and continued to dock port side alongside.

Continued on next page

Simulation 17 Continued

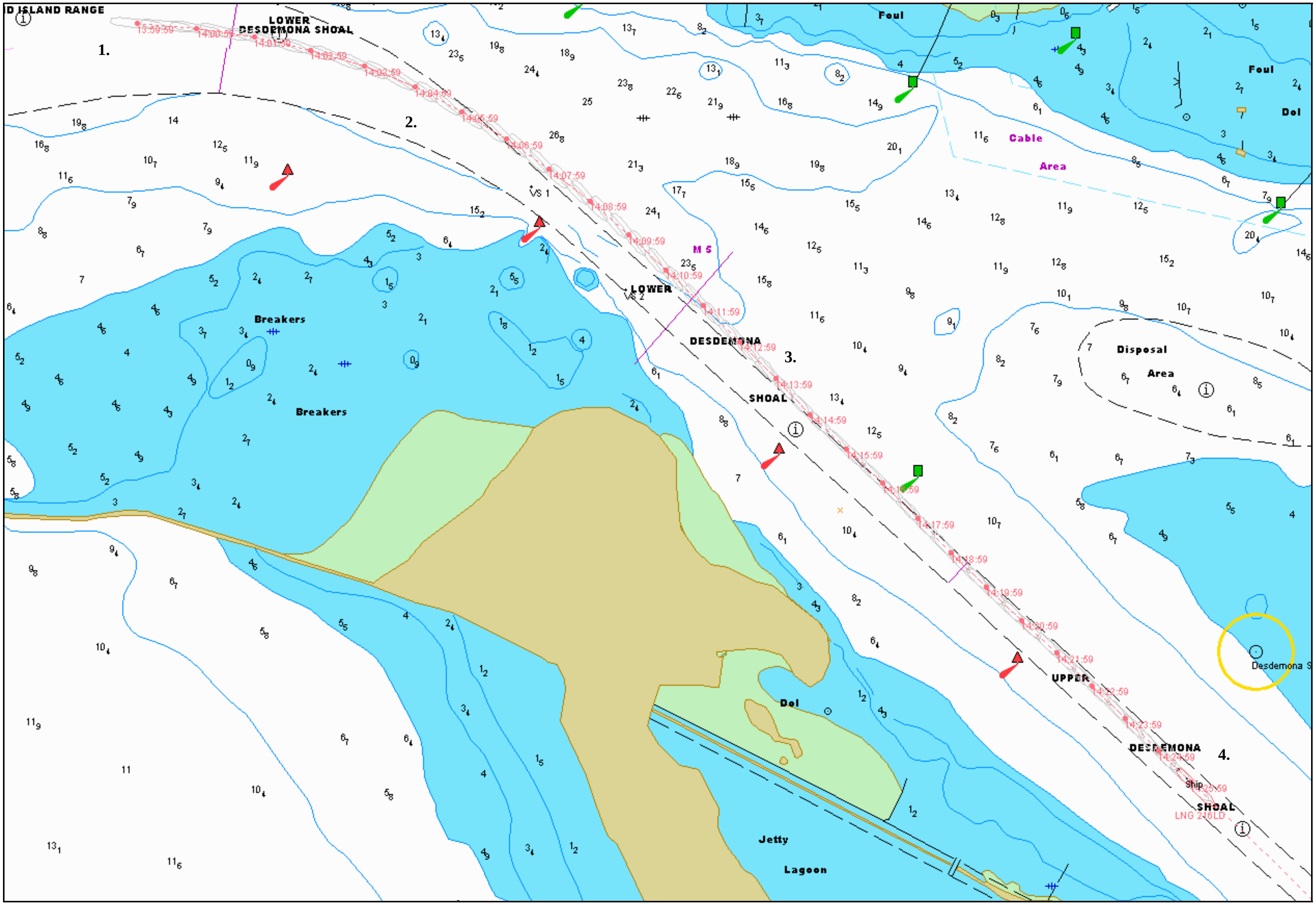


Simulation 18

Objective	Establish operational parameters for the turn between Buoys 12 and 20.
Description	Inbound Ship type: LNG 216 LD Start Position: Buoy 11 Start course and speed: 096T X 11.8 knots Current: Base Flood Tide: Lower Low Water Wind: SW 25 knots increasing to SW 30 knots Waves: 1ft Tug forces used: 2 X 75 BP
Significant Events	1. 14:00 Started off at half ahead, tug tethered on stern. 2. 14:04 Increased winds to SW 30 knots. 3. 14:14 Began using stern tug to control heading and speed. Vessel speed 9.8 knots. 4. 14:26 Reduced engines to slow ahead. Vessel speed 8.1 knots.
Conclusions	Good control of speed and heading maintained by using stern tug.

Continued on next page

Simulation 18 Continued



Simulation 1

Objective

Establish operational parameters for undocking from the terminal.

Description

Outbound
Ship type: LNG 140 BL
Start Position: Terminal starboard side alongside
Start course and speed: 097T X 0 knots
Current: Base Flood
Tide: Lower Low Water
Wind: SW 25 knots
Waves: 1ft
Tug forces used: 3 X 75 BP

Significant Events

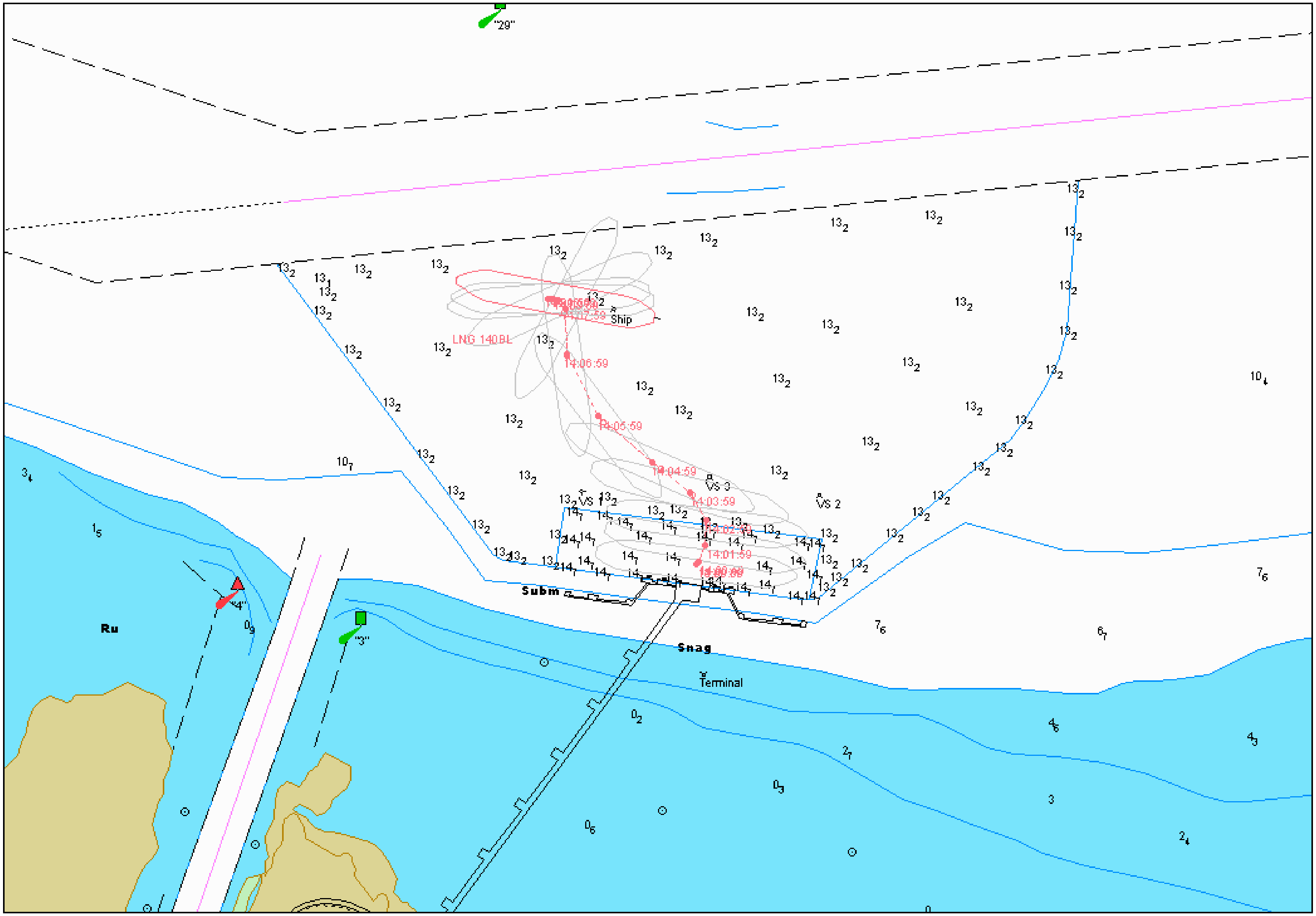
14:00 Tug 1 starboard bow; Tug 2 port bow; Tug 3 port quarter.
14:01 All tugs used to pull vessel laterally off berth. Ship's engine half astern.
14:03 Ship's engine full astern.
14:04 Tugs used to turn ship to starboard.
14:05 Ship's engine stopped.
14:07 Ship's rudder hard to starboard, engines to half ahead.
14:11 Ship in position to join channel.

Conclusions

Good control of speed and heading maintained throughout.

Continued on next page

Simulation 1 Continued

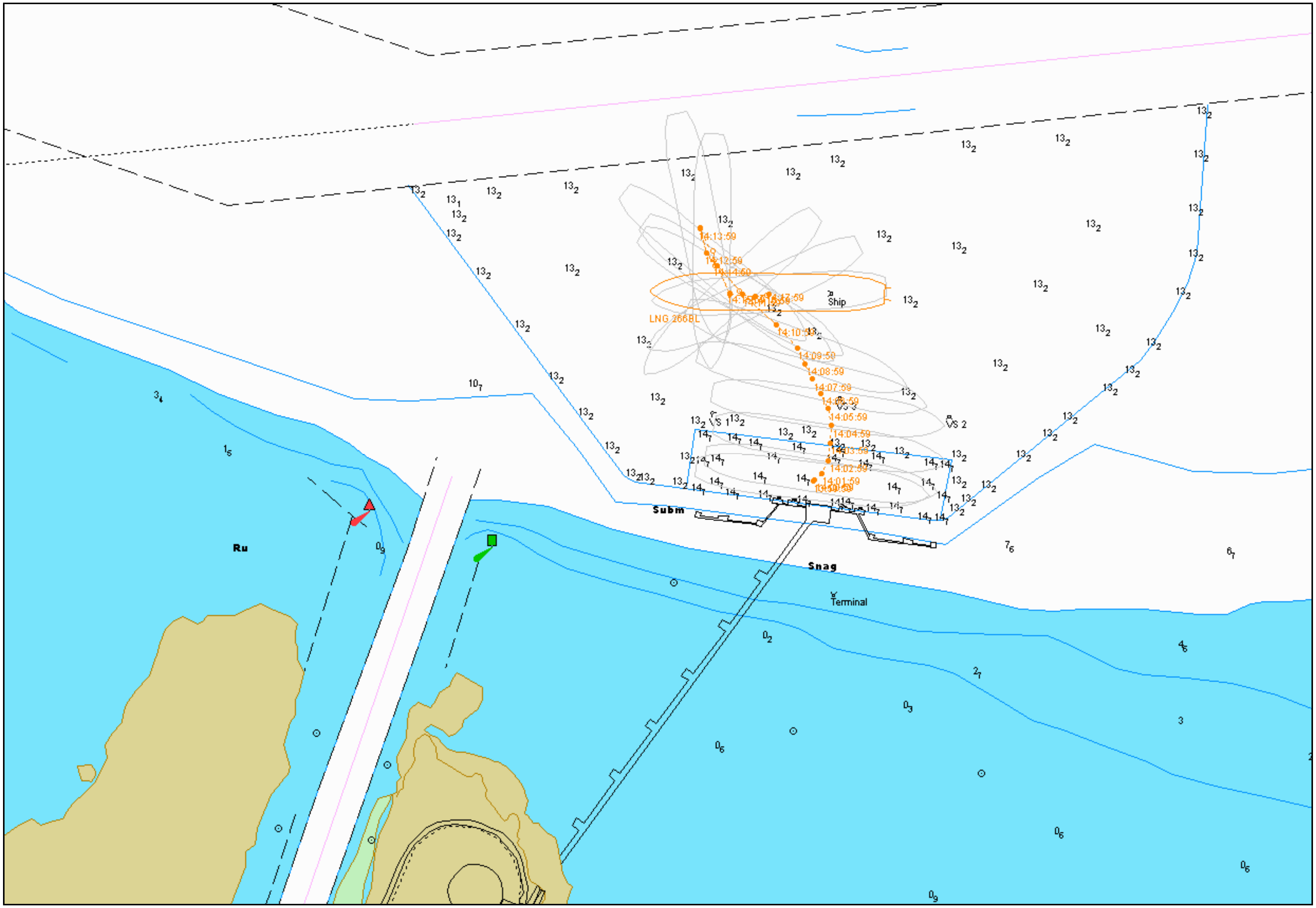


Simulation 2

Objective	Establish operational parameters for undocking from the terminal.
Description	Outbound Ship type: LNG 266 BL Start Position: Terminal starboard side alongside Start course and speed: 097T X 0 knots Current: Base Flood Tide: Lower Low Water Wind: SW 20 knots Waves: 1ft Tug forces used: 3 X 75 BP
Significant Events	14:00 Tug 1 starboard bow; Tug 2 port bow; Tug 3 center lead aft. 14:01 Port bow tug and ship's starboard engine half astern to bring ship laterally off dock. 14:07 Ship's engines half astern and stern tug pulling stern to port. 14:12 Bow tugs pushing bow to starboard. Ship's engines split to accelerate turn to starboard. 14:18 Adequate rate of turn to complete turn to starboard and line up for channel.
Conclusions	Good control of speed and heading maintained throughout.

Continued on next page

Simulation 2 Continued



Simulation 21

Objective

Establish operational parameters for undocking from the terminal.

Description

Outbound
Ship type: LNG 140 BL
Start Position: Terminal starboard side alongside
Start course and speed: 097T X 0 knots
Current: Base Flood
Tide: Lower Low Water
Wind: NW 25 knots
Waves: 1ft
Tug forces used: 3 X 75 BP

Significant Events

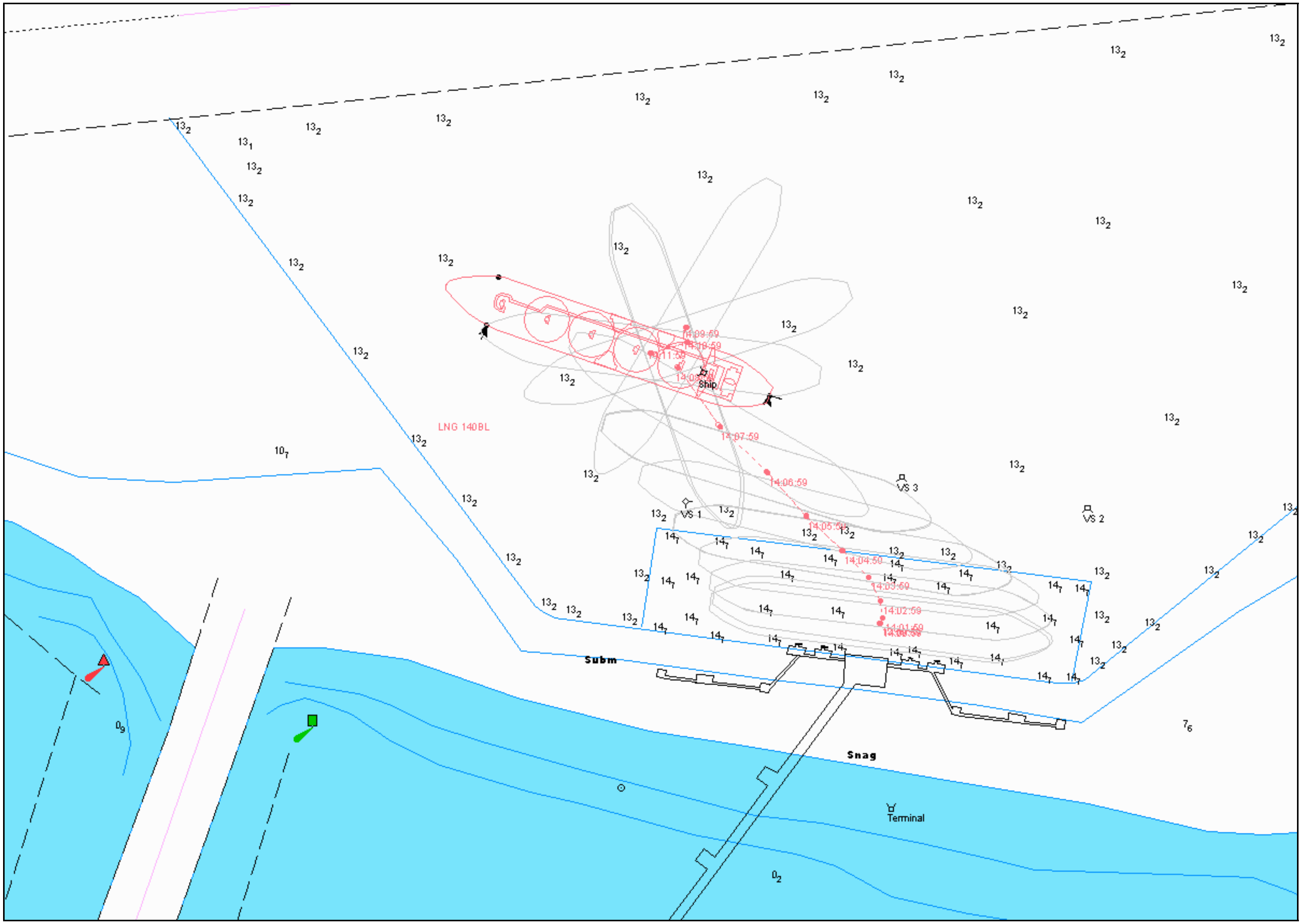
14:00 Tug 1 starboard bow; Tug 2 port bow; Tug 3 center lead aft.
14:02 Port bow tug and stern tug pulling ship off dock. Ship's engine half astern.
14:06 Stern tug pulling stern to port full.
14:10 Ship's rudder hard to starboard; engine half ahead; bow tugs working ship's bow to starboard.
14:12 Ship lined up for channel.

Conclusions

Good control of speed and heading maintained throughout.

Continued on next page

Simulation 21 Continued



Simulation 22

Objective Establish operational parameters for undocking from the terminal.

Description

Outbound
Ship type: LNG 266 BL
Start Position: Terminal starboard side alongside
Start course and speed: 097T X 0 knots
Current: Base Ebb
Tide: Lower Low Water
Wind: NW 25 knots
Waves: 1ft
Tug forces used: 3 X 75 BP

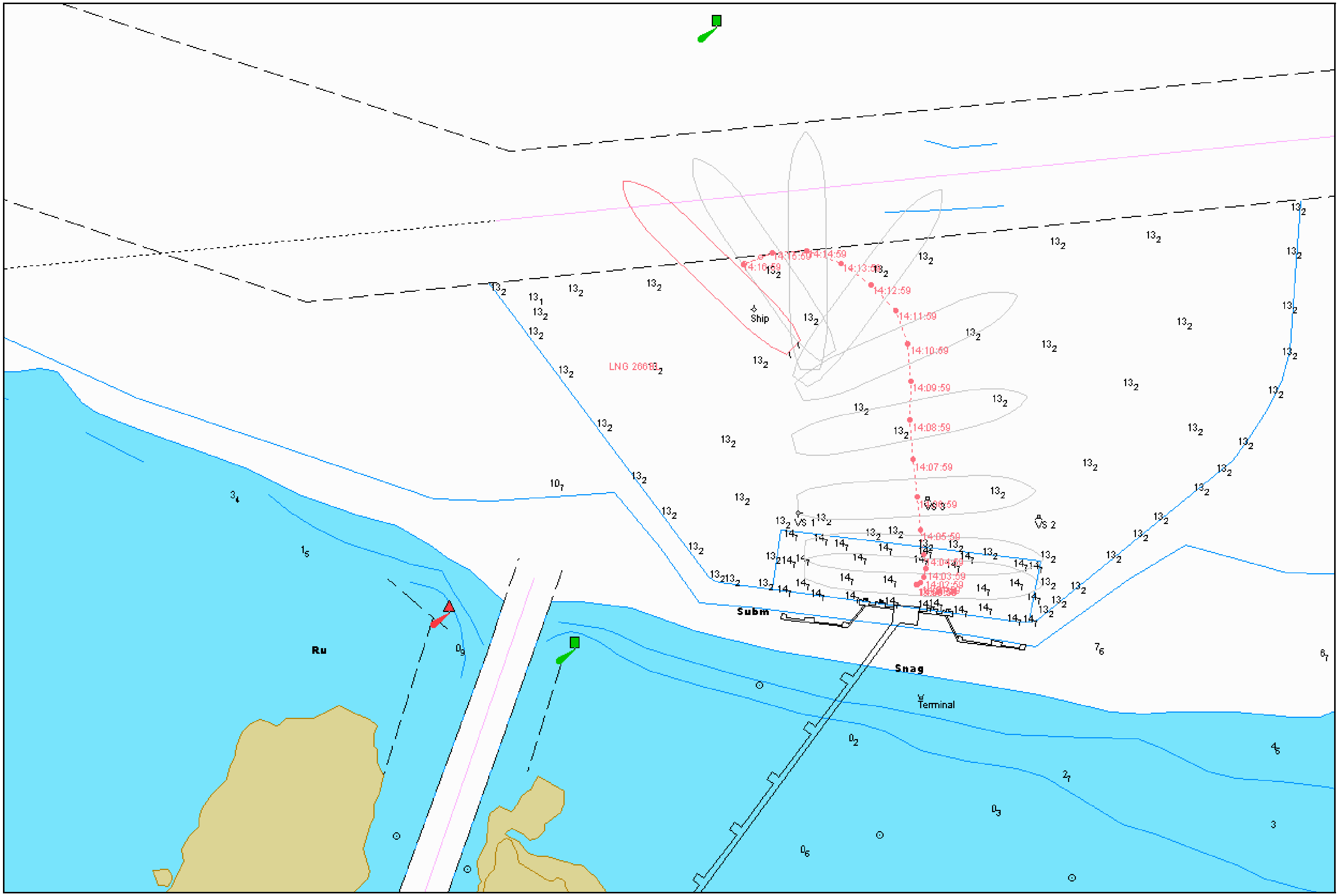
Significant Events

14:00 Tug 1 starboard bow; Tug 2 port bow; Tug 3 center lead aft.
14:03 All tugs working to move ship laterally off dock.
14:04 Ship's rudder hard to starboard, port engine dead slow ahead, starboard engine slow astern, bow thruster full to port.
14:08 Ship's rudder hard to port; both engines dead slow ahead; bow tugs working to turn bow to port.
14:11 Ship's port engine half astern.
14:17 Adequate rate of turn to complete turn to port and line up for channel.

Conclusions Good control of speed and heading maintained throughout.

Continued on next page

Simulation 22 Continued

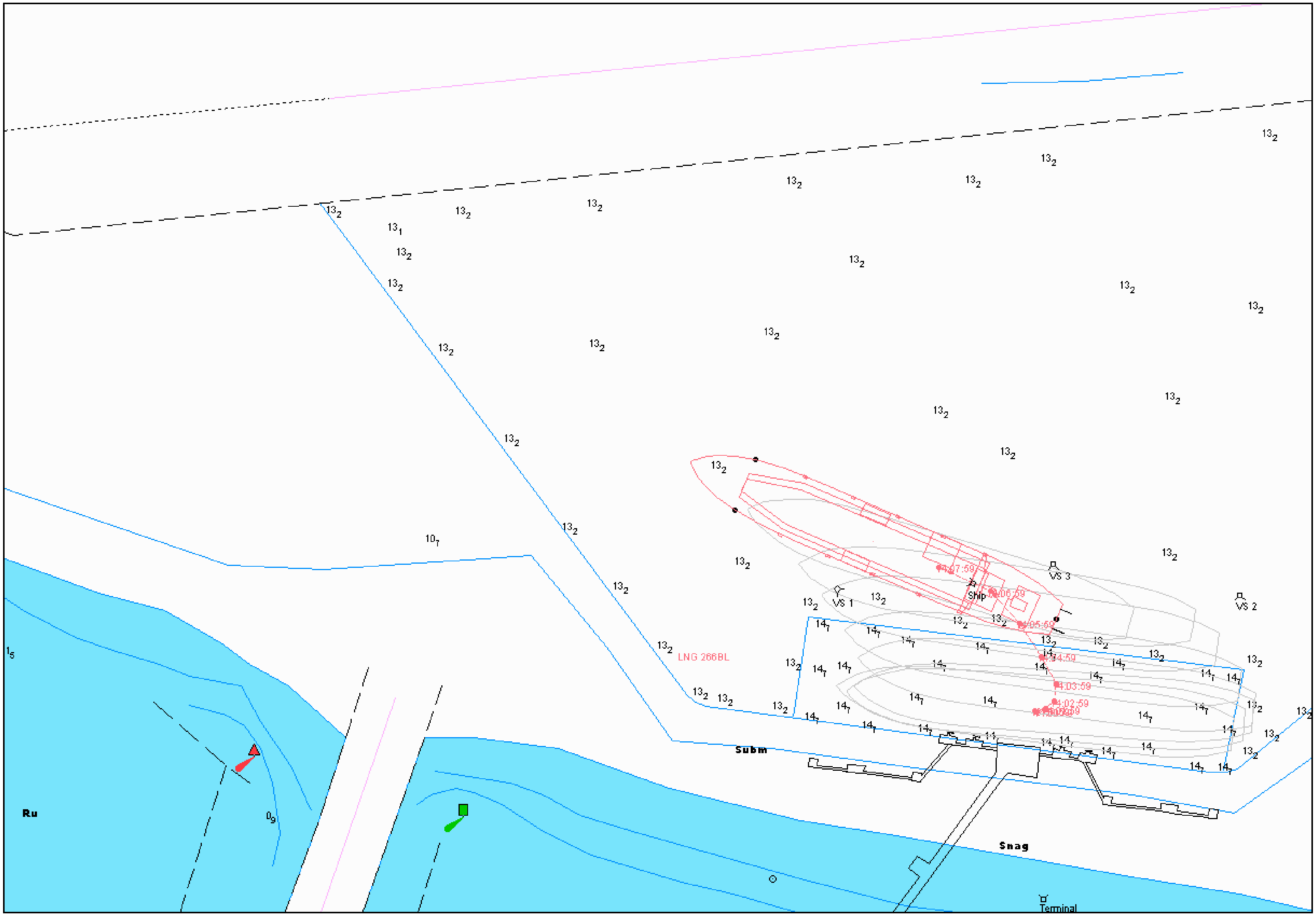


Simulation 23

Objective	Establish operational parameters for undocking from the terminal.
Description	Outbound Ship type: LNG 266 BL Start Position: Terminal port side alongside Start course and speed: 277T X 0 knots Current: Base Flood Tide: Lower Low Water Wind: NW 25 knots Waves: 1ft Tug forces used: 3 X 75 BP
Significant Events	14:00 Tug 1 starboard bow; Tug 2 port bow; Tug 3 center lead aft. 14:02 Port and stern tug working to move ship laterally off dock. Ship's rudder hard to port. Both engines dead slow ahead. 14:06 Hard to starboard and slow ahead on both engines. Bow tugs working bow to starboard. 14:08 Lined up for channel.
Conclusions	Good control of speed and heading maintained throughout.

Continued on next page

Simulation 23 Continued



Simulation 24

Objective

Establish operational parameters for undocking from the terminal.

Description

Outbound
Ship type: LNG 266 BL
Start Position: Terminal port side alongside
Start course and speed: 277T X 0 knots
Current: Base Ebb
Tide: Lower Low Water
Wind: NW 25 knots
Waves: 1ft
Tug forces used: 3 X 75 BP

Significant Events

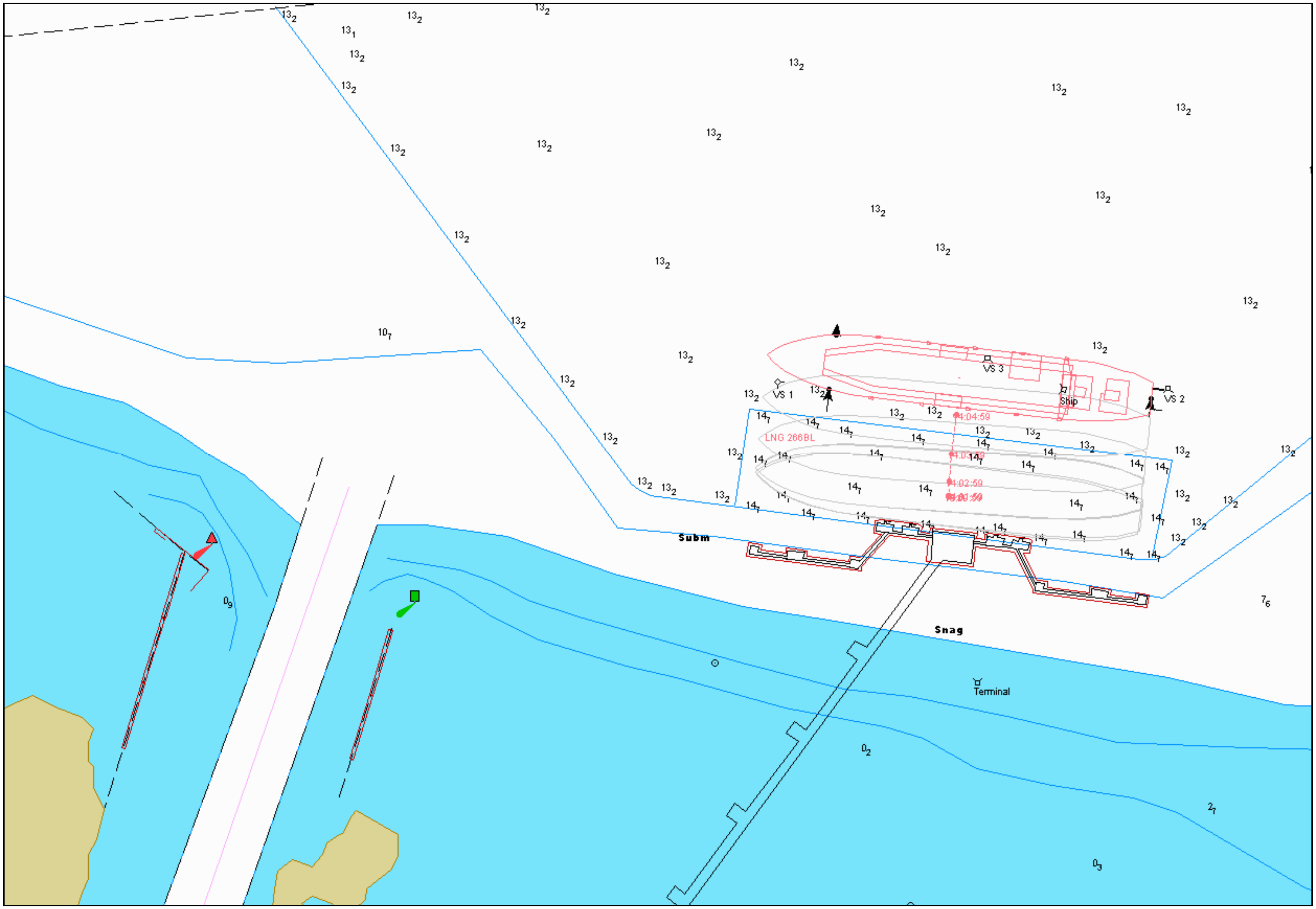
14:00 Tug 1 starboard bow; Tug 2 port bow; Tug 3 center lead aft.
14:02 All tugs used to move ship laterally off dock.
14:03 Port engine slow astern to hold ship against ebb current.
14:05 Ship moved slowly off dock under control.

Conclusions

Good control of speed and heading maintained throughout.

Continued on next page

Simulation 24 Continued



Simulation 2

Objective

Establish operational parameters for approach and docking at the terminal.

Description

Inbound – Starboard side docking
Ship type: LNG 266 LD
Start Position: Hammond
Start course and speed: 132T X 3.7 knots
Current: Base Ebb
Tide: Lower Low Water
Wind: SW 25 knots
Waves: 0ft
Tug forces used: 3 X 75T BP

Significant Events

14:00 Started off at dead slow ahead, tug tethered on stern,
14:02 Second tug and third tug made up on the each bow.

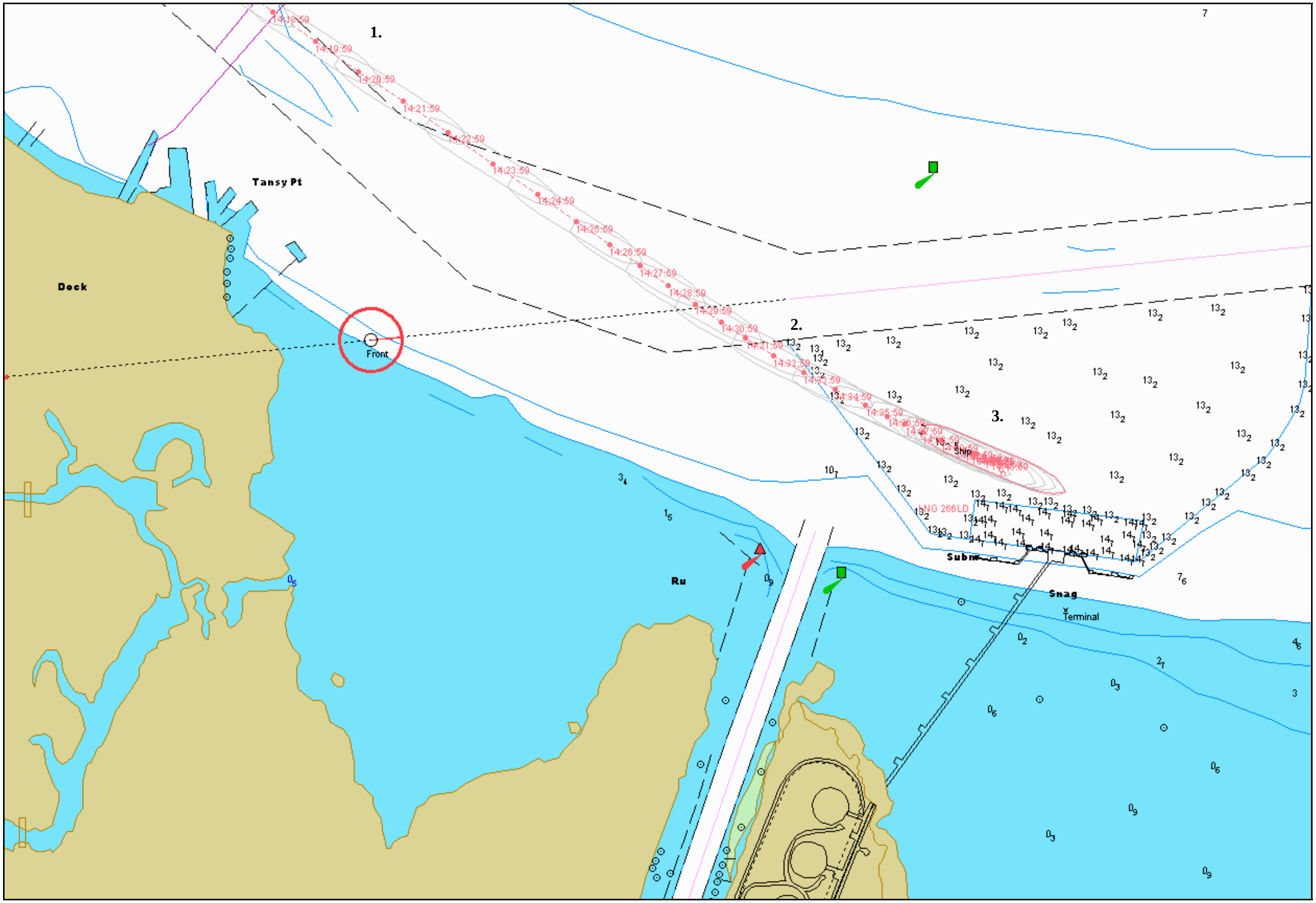
1. 14:19 Vessel proceeding at 4 knots.
2. 14:33 Entered turning basin at 2.5 knots.
3. 14:54 Vessel moving slowly towards dock.

Conclusions

Slow progress going alongside due to SW wind, but more power available.

Continued on next page

Simulation 2 Continued

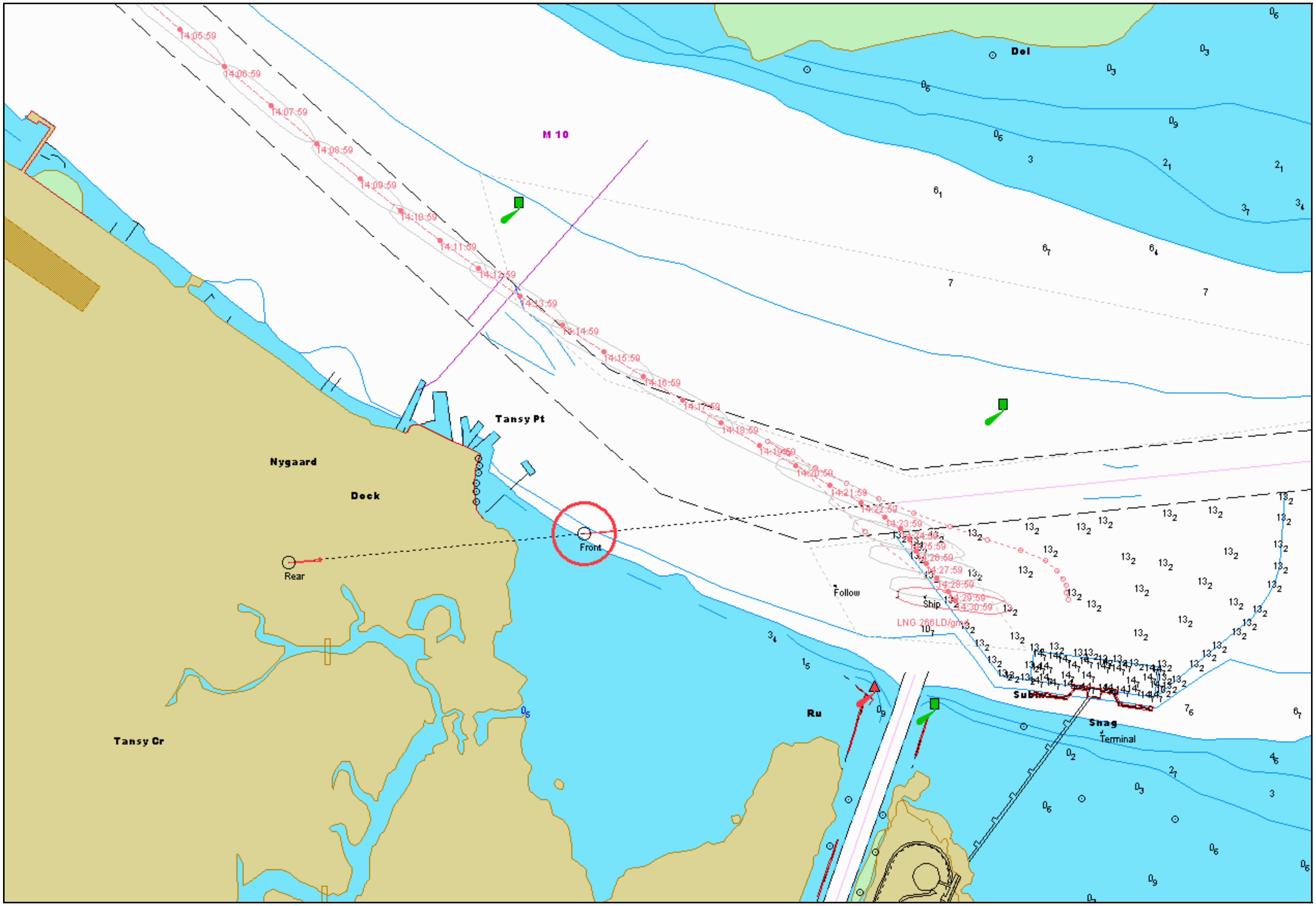


Simulation 26 A

Objective	Establish operational parameters for approach and docking at the terminal.
Description	Inbound – Starboard side docking Ship type: LNG 266 LD Start Position: Hammond Start course and speed: 132T X 6.6 knots Current: Base Flood Tide: Lower Low Water Wind: NW 25 knots Waves: 0ft Tug forces used: 3 X 75T BP
Significant Events	14:00 Started off at dead slow ahead, tug tethered on stern. 14:02 Second tug and third tug made up on the each bow. 14:15 Vessel proceeding at 5 knots. 14:24 Vessel slowed to 1 knot. 14:31 Vessel ran aground after drifting south in NW wind and flood current.
Conclusions	First attempt slowed down too early and ship drifted south and grounded in shallows west of the turning basin. See Simulation 26 B for restart.

Continued on next page

Simulation 26 A Continued



Simulation 26 B

Objective

Establish operational parameters for approach and docking at the terminal.

Description

Inbound – Starboard side docking
Ship type: LNG 266 LD
Start Position: Hammond
Start course and speed: 112T X 2 knots
Current: Base Flood
Tide: Lower Low Water
Wind: NW 25 knots
Waves: 0ft
Tug forces used: 3 X 75T BP

Significant Events

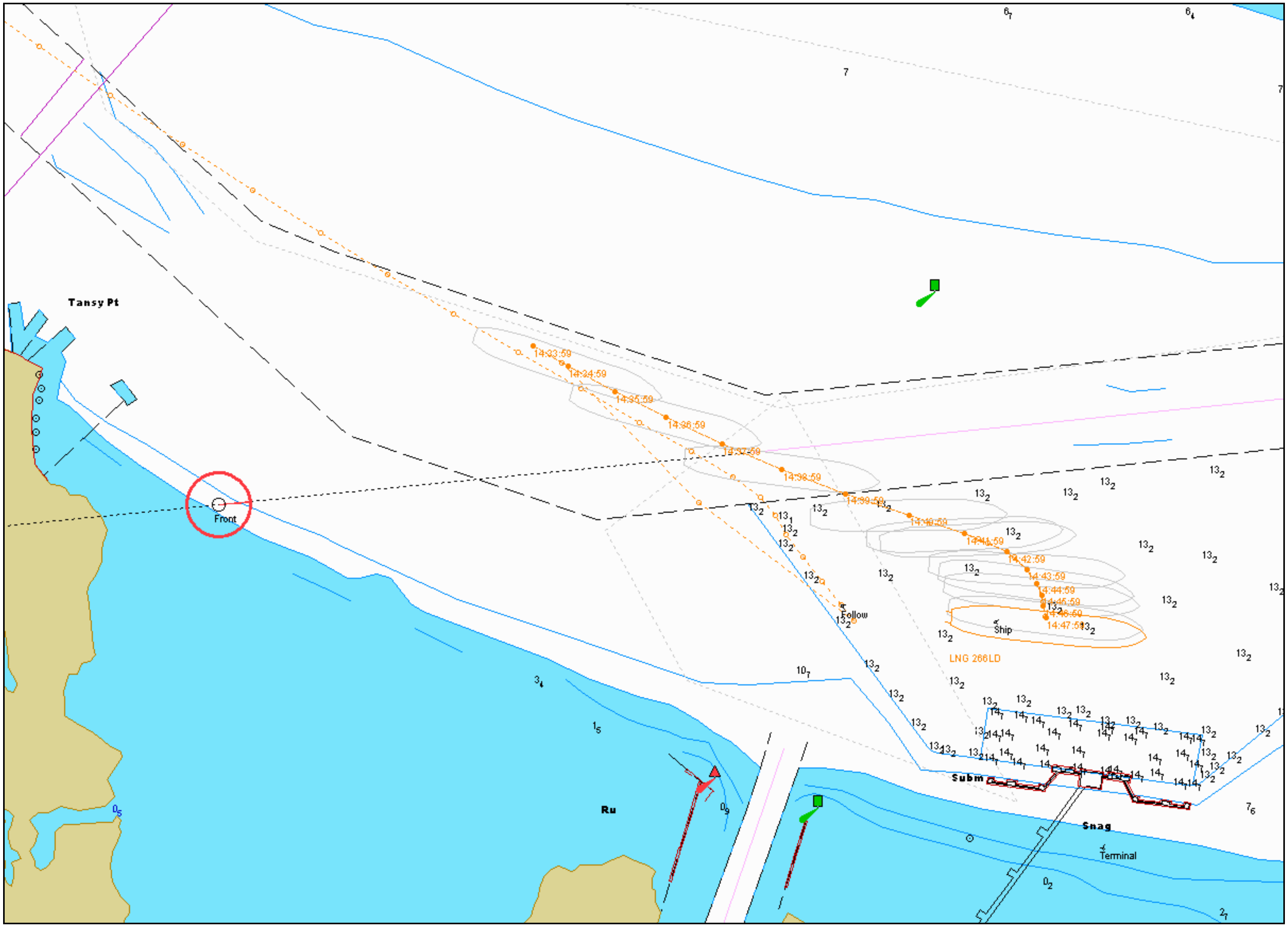
14:24 Restarted after repositioning ship, three tug forces: center lead aft, port quarter and port bow.
14:47 Ship moving laterally towards the dock at 0.7 knots.

Conclusions

Ship stopped in basin off dock with controllable lateral motion of 0.7 knots towards dock.

Continued on next page

Simulation 26 B Continued



Simulation 27

Objective

Establish operational parameters for undocking from the terminal.

Description

Outbound
Ship type: LNG 266 LD
Start Position: Terminal starboard side alongside
Start course and speed: 097T X 0 knots
Current: Moderate Ebb
Tide: Lower Low Water
Wind: NW 25 knots
Waves: 1ft
Tug forces used: 3 X 75 BP

Significant Events

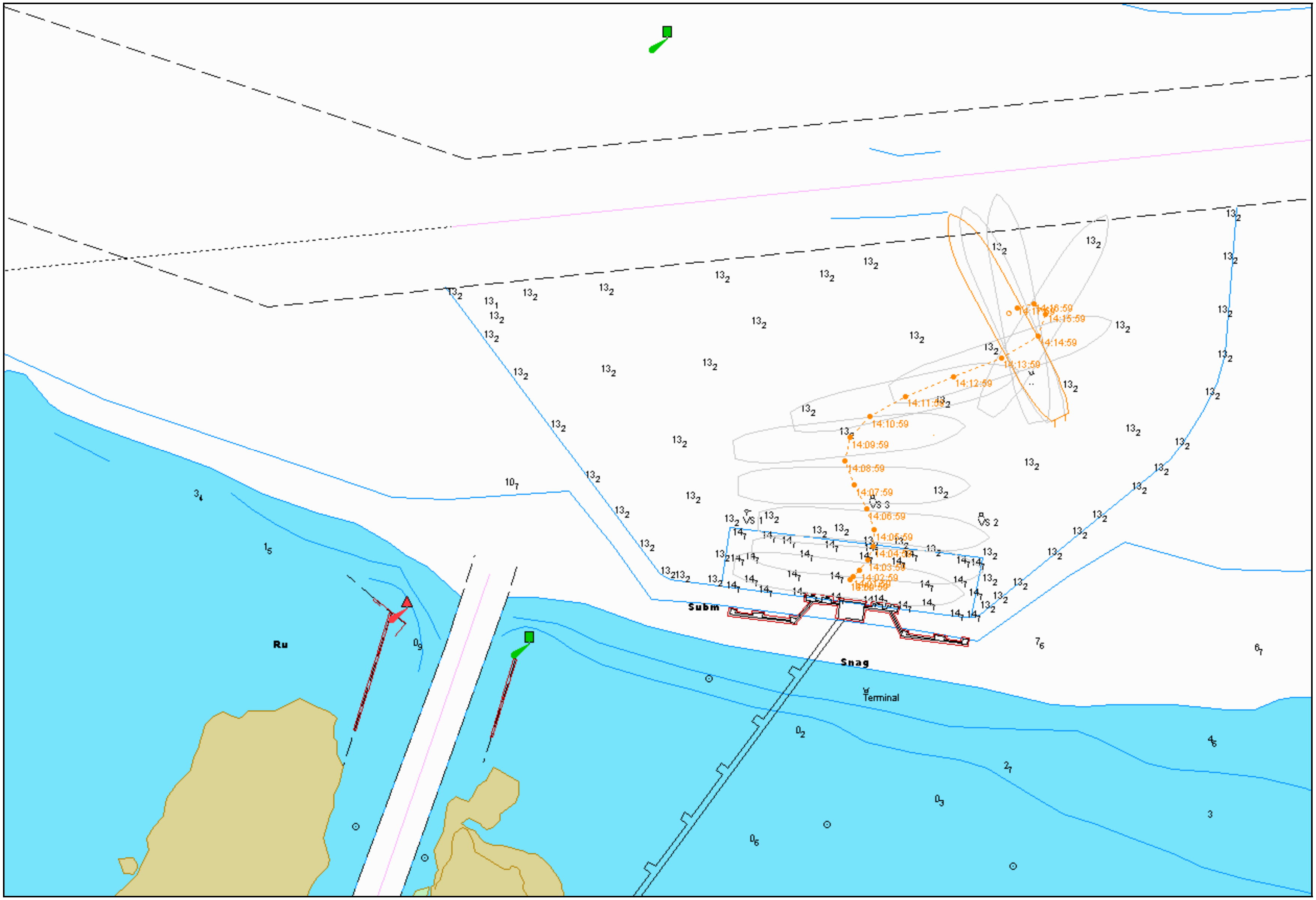
14:00 Tug 1 line through bull nose; Tug 2 port bow; Tug 3 center lead aft.
14:03 All tugs used at full power with bow thruster full to port to move ship laterally off dock.
14:09 Ship's engines slow ahead on both. Bow tugs working bow to port.
14:14 Stopped engines.
14:15 Full astern on the port engine.
14:17 Port engine stopped; starboard engine dead slow ahead; rudder hard to port.
14:19 Turning into channel under control.

Conclusions

Successful maneuver but used all three tugs and bow thruster to get off dock and make turn.

Continued on next page

Simulation 27 Continued

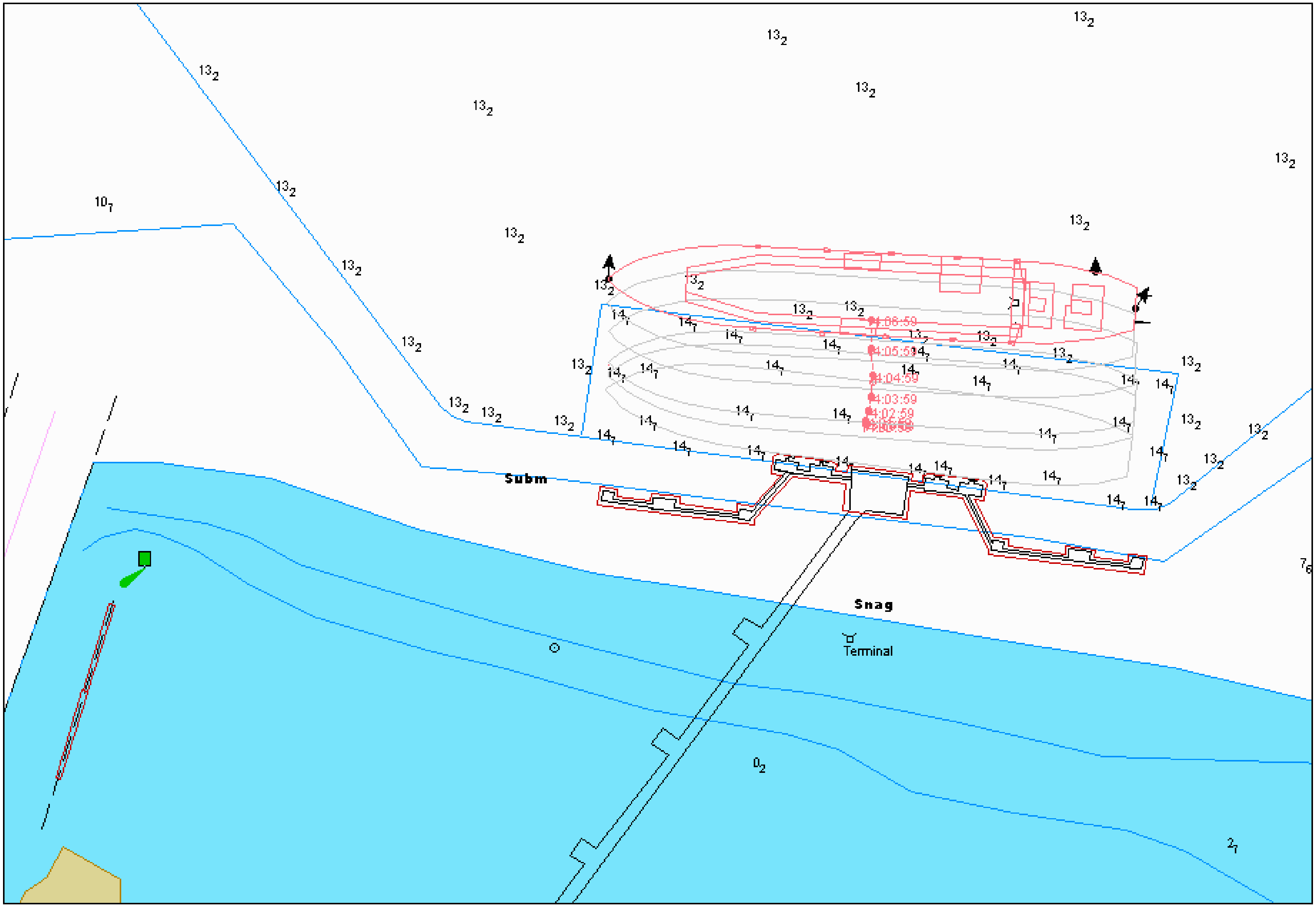


Simulation 28

Objective	Establish operational parameters for undocking from the terminal.
Description	Outbound Ship type: LNG 266 LD Start Position: Terminal port side alongside Start course and speed: 277T X 0 knots Current: Moderate Ebb Tide: Lower Low Water Wind: NW 25 knots Waves: 1ft Tug forces used: 3 X 75 BP
Significant Events	14:00 Tug 1 line through bull nose; Tug 2 port bow; Tug 3 center lead aft. 14:03 All tugs used at half power with bow thruster full to starboard to move ship laterally off dock. 14:04 Ship's port engine slow astern. 14:07 Both engines slow astern. 14:08 Ship moving laterally away form dock at 0.6 knots.
Conclusions	Successful maneuver using moderate tug power.

Continued on next page

Simulation 28 Continued



Simulation 2

Objective

Establish operational parameters for undocking from the terminal.

Description

Outbound
Ship type: LNG 266 LD
Start Position: Terminal starboard side alongside
Start course and speed: 097T X 0 knots
Current: Max Ebb
Tide: Lower Low Water
Wind: NW 10 knots
Waves: 1ft
Tug forces used: 3 X 75 BP

Significant Events

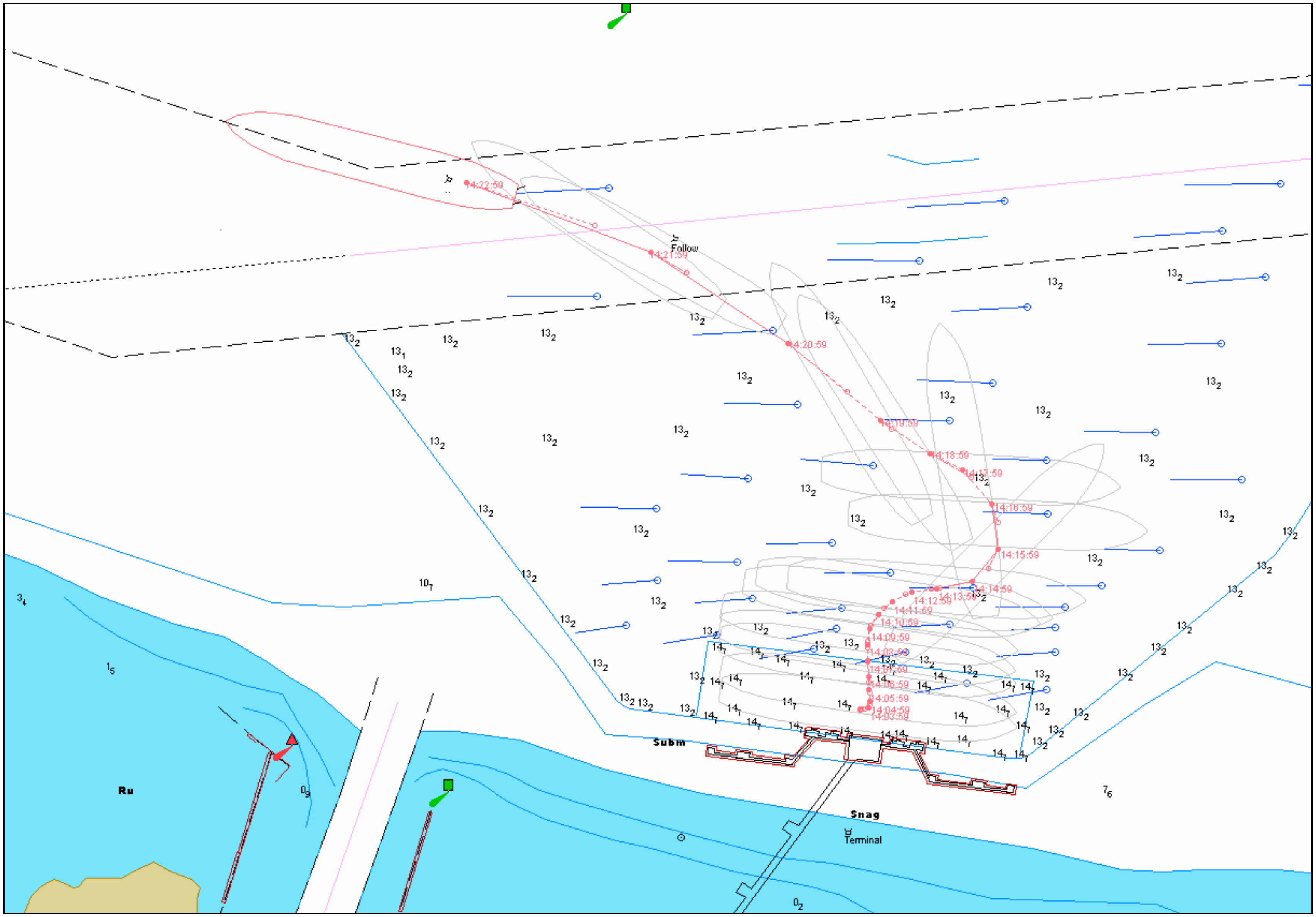
14:00 Tug 1 line through bull nose; Tug 2 starboard bow; Tug 3 center lead aft.
14:03 Bow tugs working bow to port at full; stern tug at half; bow thruster full to port.
14:09 Ship's starboard engine slow ahead, rudder hard to port.
14:12 Starboard bow tug moved to port quarter.
14:14 All tugs working full to turn ship to port. Half ahead and hard a port on the ship.
14:21 Ship's rudder hard to port, full ahead on both engines.
14:23 Lined up for channel.

Conclusions

Successful maneuver using moderate to full power with the tugs supplemented with thruster and engine orders.
Wind 10 knots

Continued on next page

Simulation 2 Continued

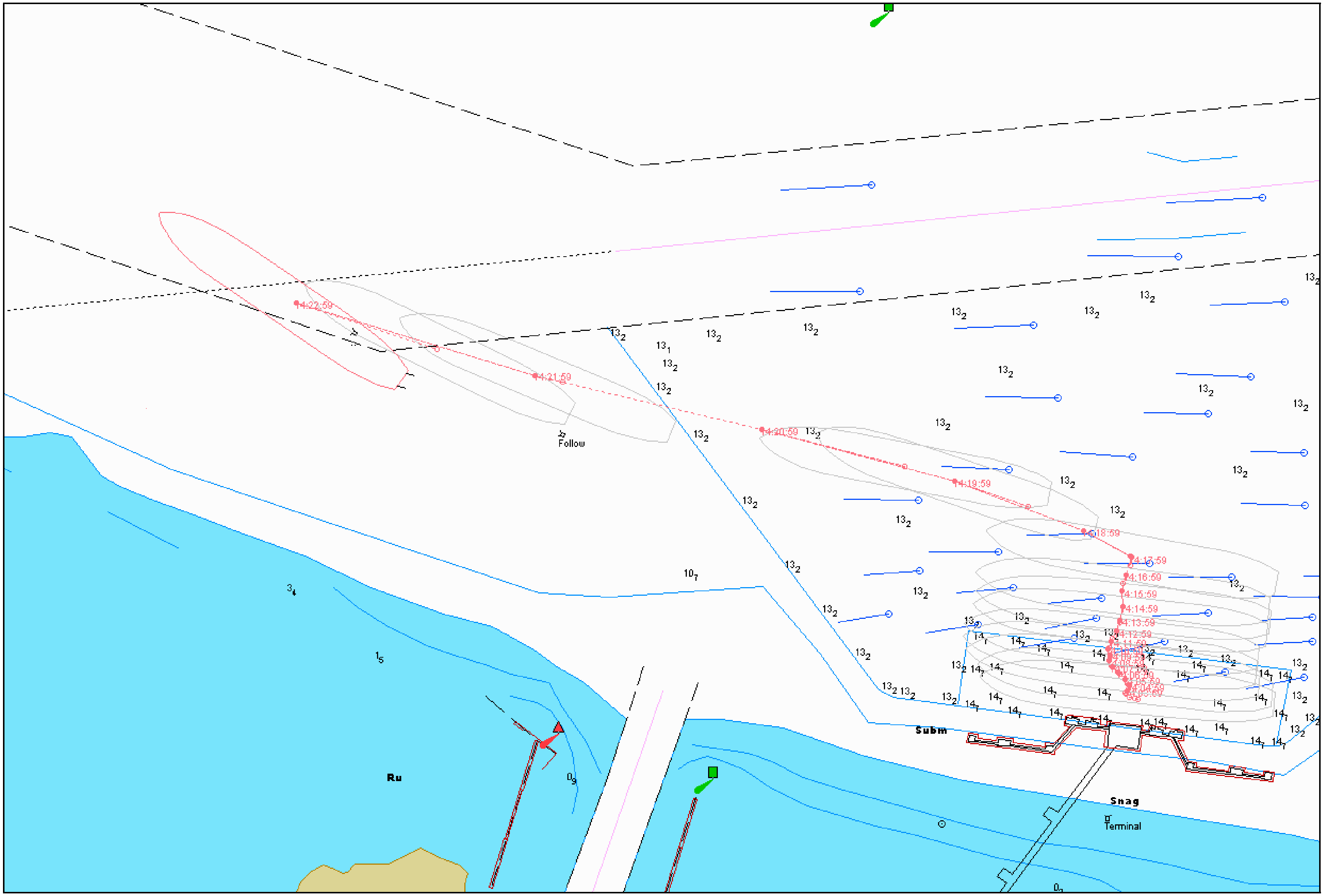


Simulation 3

Objective	Establish operational parameters for undocking from the terminal.
Description	Outbound Ship type: LNG 266 LD Start Position: Terminal port side alongside Start course and speed: 277T X 0 knots Current: Max Ebb Tide: Lower Low Water Wind: NW 10 knots Waves: 1ft Tug forces used: 3 X 75 BP
Significant Events	14:00 Tug 1 line through bull nose; Tug 2 starboard bow; Tug 3 center lead aft. 14:03 All tugs working at half power to move ship off dock. Ship's engines used astern against ebb current. 14:14 Tug 2 and 3 increased to full away from the dock. 14:12 Starboard bow tug moved to port quarter. 14:18 Full ahead on both engines, rudder hard to starboard. Stern tug stopped, both bow tugs working bow to starboard full. 14:19 Tugs stopped. 14:21 Lined up for channel.
Conclusions	Successful maneuver using moderate to full power with the tugs supplemented with thruster and engine orders. Wind 10 knots

Continued on next page

Simulation 3 Continued



Simulation 31

Objective

Establish operational parameters for approach and docking at the terminal.

Description

Inbound – Starboard side docking
Ship type: LNG 266 LD
Start Position: Hammond
Start course and speed: 132T X 3.5 knots
Current: Max Flood
Tide: Lower Low Water
Wind: NW 10 knots
Waves: 0ft
Tug forces used: 3 X 75T BP

Significant Events

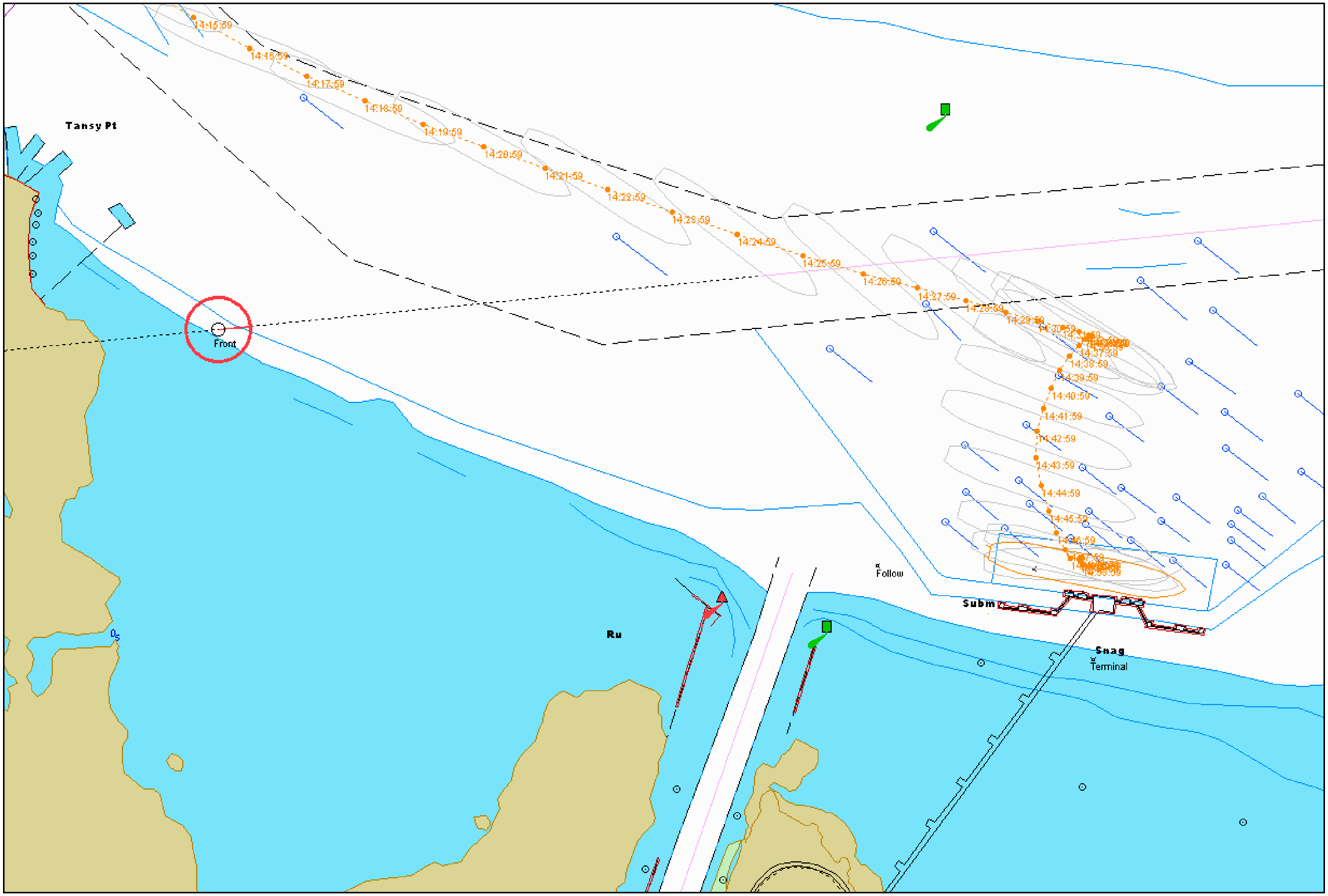
14:00 Started off at dead slow ahead, tug tethered on stern.
14:02 Tug 2 made up on the port quarter and Tug 3 made up on the port bow. Stern tug backing half.
14:15 Ship's speed 3.8 knots. Used stern tug to control ship's speed and heading.
14:34 Used tugs and ship's engine to stop ship in turning basin.
14:43 Used tugs and ship's propulsion systems to maneuver ship laterally towards dock.
14:55 Ship docked successfully with approximately 0.3 knots lateral motion.

Conclusions

Docking controllable using tugs and ship's propulsion systems. Could stop ship with 1.5 knots of lateral motion caused by wind and current. Wind 10 knots

Continued on next page

Simulation 31 Continued



Simulation 32

Objective

Establish operational parameters for approach and docking at the terminal.

Description

Inbound – port side docking
Ship type: LNG 266 LD
Start Position: Hammond
Start course and speed: 132T X 3.3 knots
Current: Max Flood
Tide: Lower Low Water
Wind: NW 10 knots
Waves: 0ft
Tug forces used: 3 X 75T BP

Significant Events

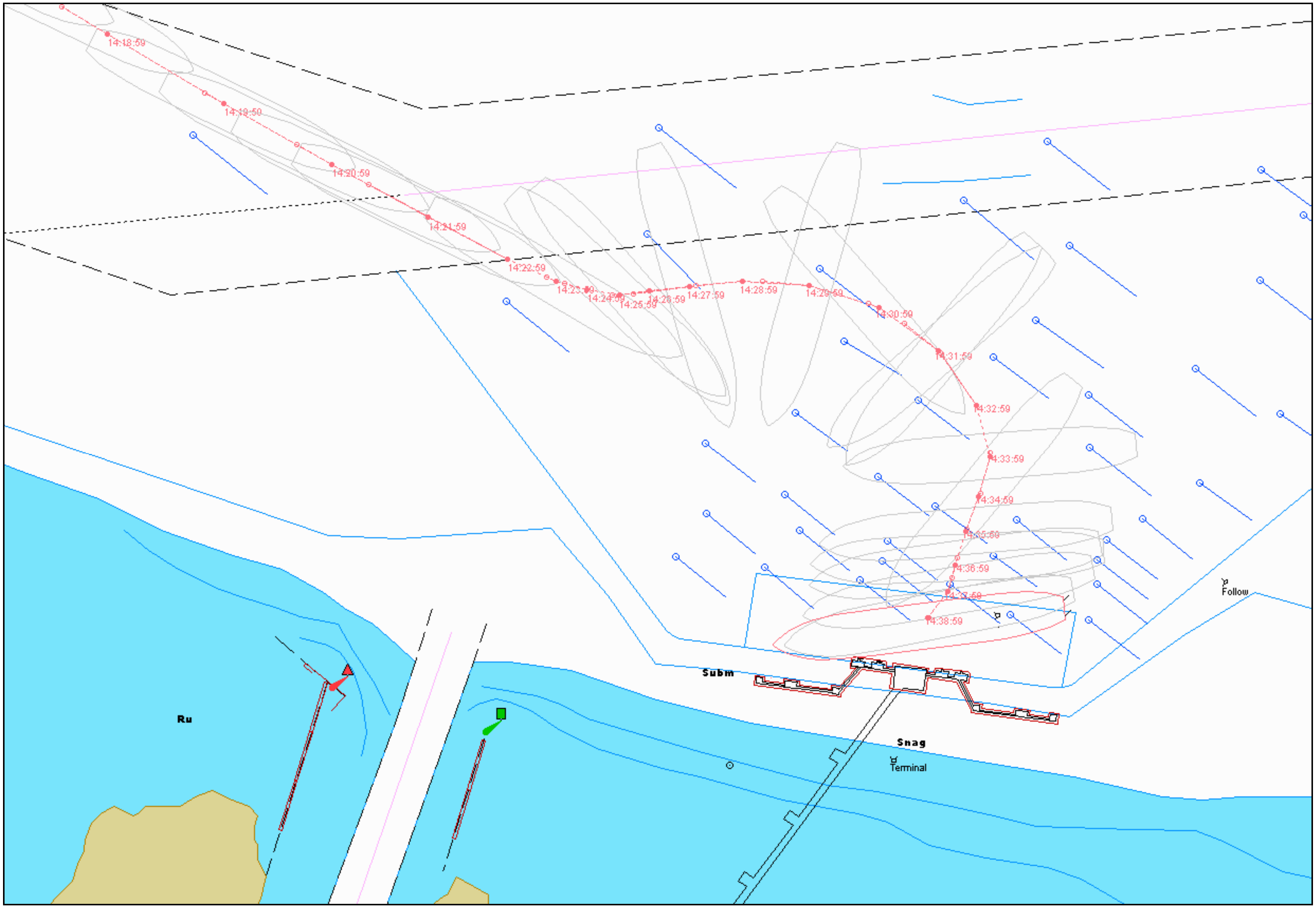
14:00 Started off at dead slow ahead, tug tethered on stern.
14:02 Tug 2 and Tug 3 made up on each bow.
14:18 Ship's speed 5.6 knots. Stopped engines.
14:22 Full astern on both engines, using tugs to slow down and turn ship to starboard.
14:34 Turn completed in basin, began moving laterally towards dock.
14:39 Two tugs on the bow working full away from the dock and bow thruster full to port.
14:40 Bow strikes dock at 1 knot lateral speed.

Conclusions

Port side alongside docking was difficult to control ship. The relative angle of current caused the bow of the ship to set down onto the dock. Two tugs working full power on the bow and the bow thruster at full could not stop the bow's lateral motion of more than one knot.

Continued on next page

Simulation 32 Continued



Simulation 33

Objective

Establish operational parameters for LNG Carrier casualty scenarios.

Description

Inbound
Ship type: LNG 266 LD
Start Position: Between Buoy 8 and 10
Start course and speed: 080T X 13.1 knots
Current: Base Flood
Tide: Lower Low Water
Wind: SW 25 knots
Waves: 1ft
Tug forces used: 2 X 75T BP

Significant Events

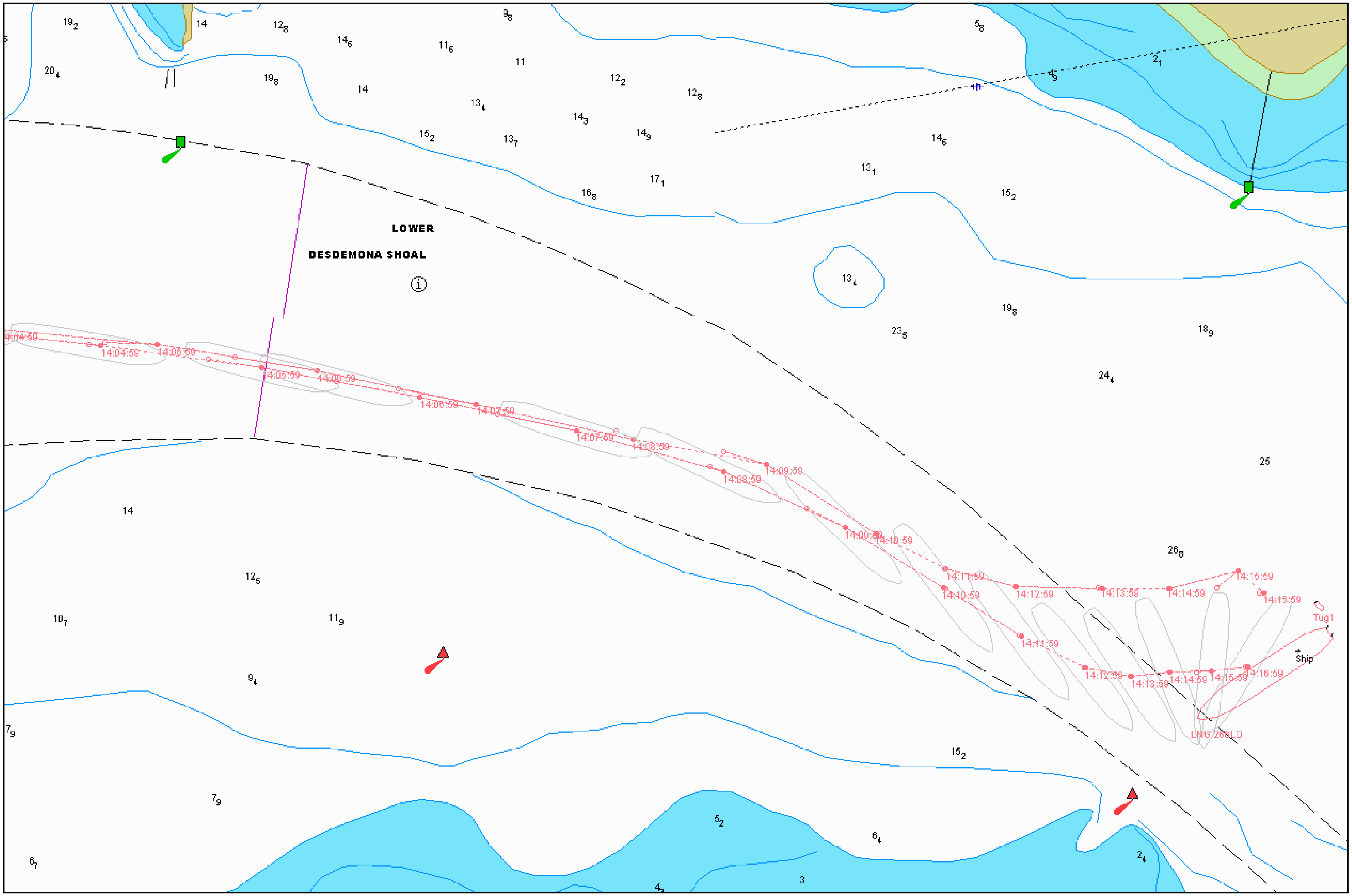
14:00 Started off at half ahead, tug tethered on stern.
14:08 Simulated hard to starboard rudder failure.
14:09 Stopped engines. Ship speed 10.4 knots.
14:10 Full astern on both engines, ship's speed 7.4 knots. Tug working on the starboard bow, pushing full.
14:11 Stern tug pulling stern to starboard.
14:12 Let go starboard anchor, 3 shots. Ship's speed 4.6 knots.
14:14 Starboard engine half ahead; port engine stopped; ship speed 0.9 knots; anchor to 4 shots.
14:15 Engines stopped. Bow tug moved to starboard bow and pushing full. Stern tug pulling stern to starboard.
14:18 Ship brought up to starboard anchor.

Conclusions

Ship could be controlled before running aground using a combination of ship's propulsion, tugs and anchor.
Note: Having the tug tethered on the stern before a casualty occurs is critical to the success of this maneuver.

Continued on next page

Simulation 33 Continued



Simulation 34

Objective

Establish operational parameters for LNG Carrier casualty scenarios.

Description

Inbound
Ship type: LNG 266 LD
Start Position: Between Buoy 8 and 10
Start course and speed: 080T X 10.1 knots
Current: Base Flood
Tide: Lower Low Water
Wind: SW 25 knots
Waves: 1ft
Tug forces used: 2 X 75T BP

Significant Events

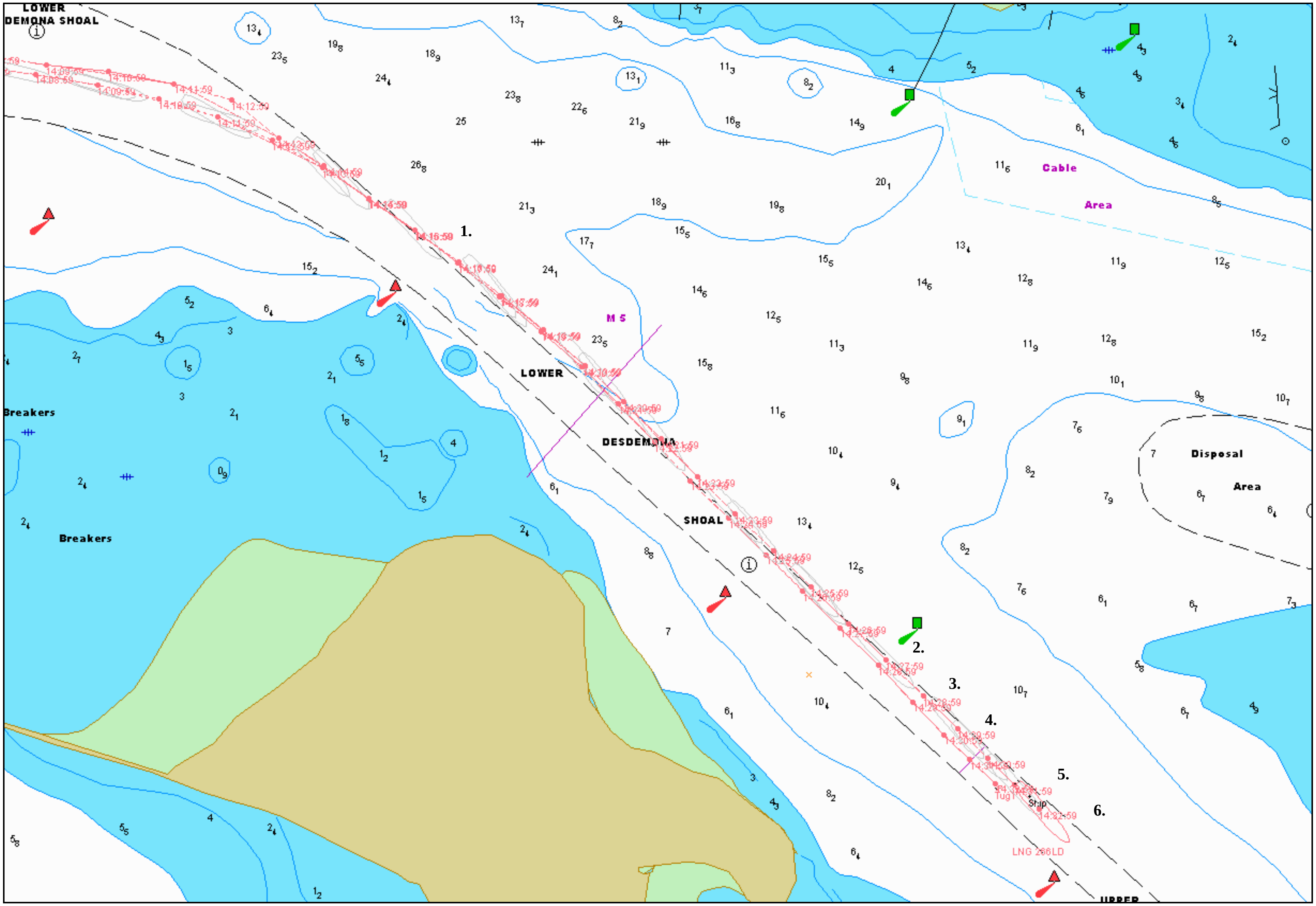
14:00 Started off at slow ahead, tug tethered on stern.
1. 14:17 Ship's speed 7.6 knots.
2. 14:28 Hard to starboard rudder failure.
3. 14:29 Stopped engine. Stern tug pulling stern to starboard easy.
4. 14:30 Half astern on the port engine.
5. 14:32 Stopped port engine, second tug made up forward through the "Bull Nose". Ship's speed 5 knots.
6. 14:33 Ship under control in channel.

Conclusions

Ship could be controlled before running aground using a combination of ship's propulsion and tugs.
Note: Having the tug tethered on the stern before a casualty occurs is critical to the success of this maneuver.

Continued on next page

Simulation 34 Continued

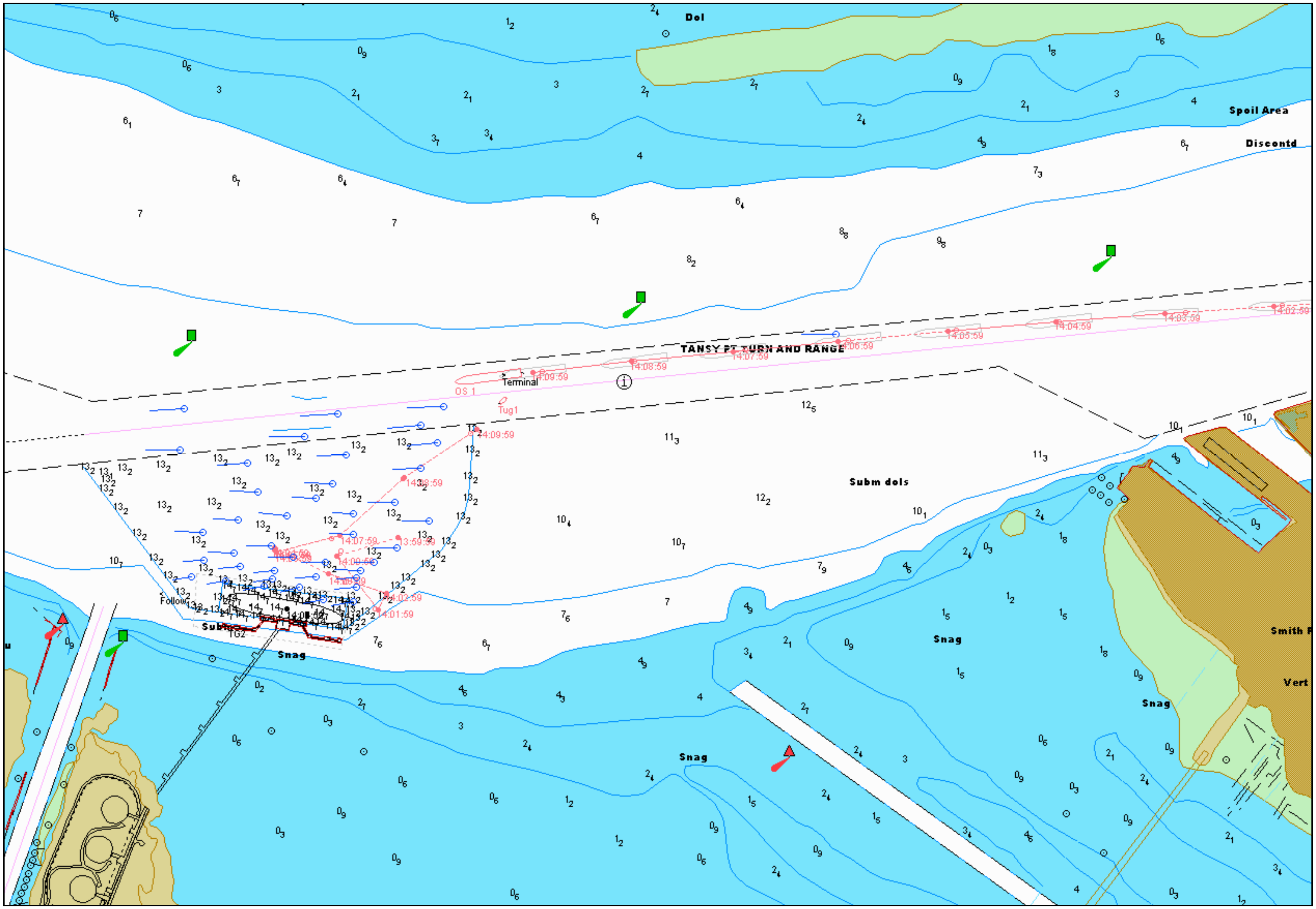


Simulation 3

Objective	Establish operational parameters for other vessel casualty scenarios.
Description	Outbound Ship type: Container Ship, 32,025 Tons displacement Start Position: Astoria Bridge Start course and speed: 262T X 10.0 knots Current: Max Ebb Tide: Lower Low Water Wind: NW 25 knots Waves: 1ft Tug forces used: 2 X 75T BP Standing by in basin
Significant Events	14:00 Started off at dead slow ahead. 14:02 to 14:07 Kick of slow ahead with hard port rudder required to compensate for strong NW wind. 14:07 Hard port rudder failure. Stopped engine. Tug assistance requested. 14:08 Engine kicked slow ahead to control rate of turn to starboard. 14:10 Ship tending to turn to starboard due to NW wind.
Conclusions	Container ship did not respond dramatically to hard port rudder failure because port 20 rudder was required to compensate for the strong NW wind. Ship did not veer into LNG terminal turning basin.

Continued on next page

Simulation 3 Continued



Simulation 36

Objective

Establish operational parameters for other vessel casualty scenarios.

Description

Outbound
Ship type: Container Ship, 32,025 Tons displacement
Start Position: Astoria Bridge
Start course and speed: 262T X 10.0 knots
Current: Max Ebb
Tide: Lower Low Water
Wind: SW 25 knots
Waves: 1ft
Tug forces used: 2 X 75T BP Standing by in basin

Significant Events

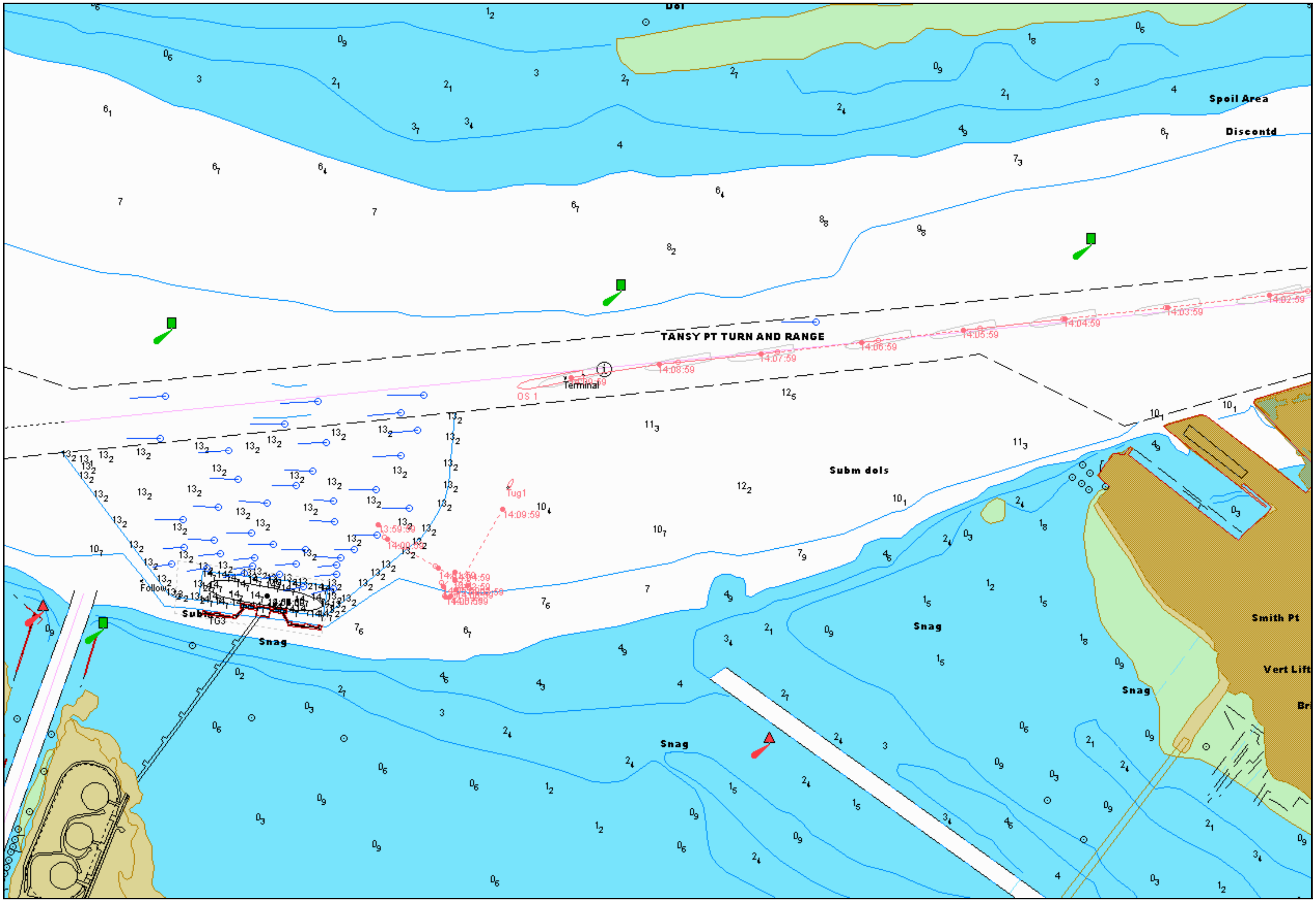
14:00 Started off at dead slow ahead.
14:02 to 14:07 Kick of slow ahead with hard starboard rudder required to compensate for strong SW wind.
14:08 Hard port rudder failure. Stopped engine. Tug assistance requested.
14:09 Engine full astern.
14:10 Engine stopped. Transverse thrust from engines full astern checked starboard turn and caused turn to starboard. Speed down to 7.4 knots.

Conclusions

Container ship did not respond dramatically to hard port rudder failure because engine was put astern and transverse thrust counteracted the swing to port caused by the hard port rudder failure. Ship did not veer into LNG terminal turning basin.

Continued on next page

Simulation 36 Continued



Simulation 37

Objective

Establish operational parameters for other vessel casualty scenarios.

Description

Outbound
Ship type: Container Ship, 32,025 Tons displacement
Start Position: Buoy 33
Start course and speed: 262T X 10.5 knots
Current: Max Ebb
Tide: Lower Low Water
Wind: SW 25 knots
Waves: 1ft
Tug forces used: 2 X 75T BP Standing by in basin

Significant Events

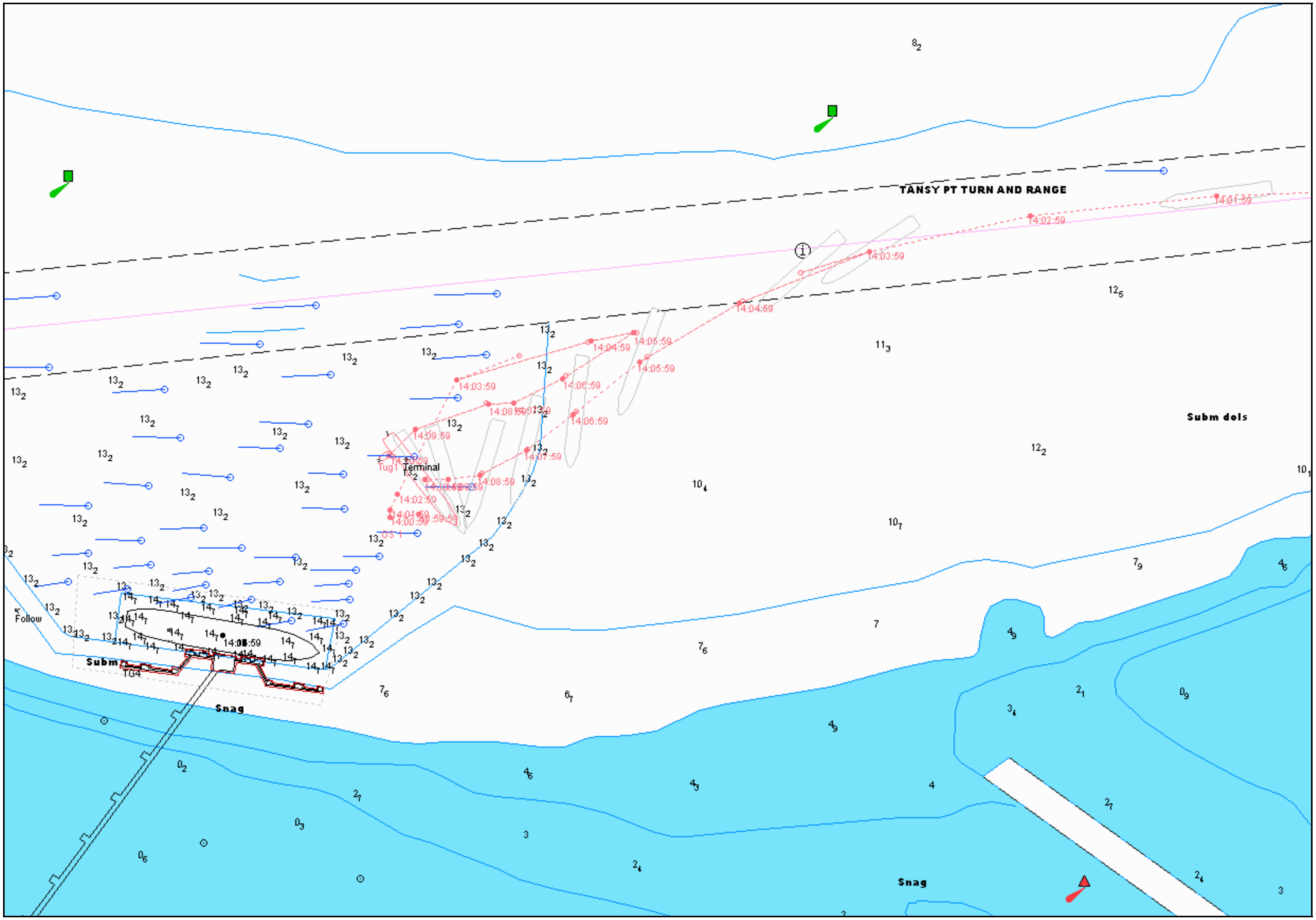
14:00 Started off at dead slow ahead.
14:02 Hard port rudder failure and loss of propulsion. Tug assistance requested.
14:06 Let go port anchor, 2 shots. Ship's speed 5.2 knots.
14:07 Let port anchor out to 3 shots. Ship's speed 3.8 knots.
14:08 Tug on starboard quarter. Let port anchor out to 7 shots. Ship's speed 2.0 knots.
14:09 Anchor holding. Ship swinging to port.

Conclusions

Container ship entered into LNG terminal turning basin, but the ship was controlled using anchors and tugs before it struck the LNG ship at the terminal.

Continued on next page

Simulation 37 Continued

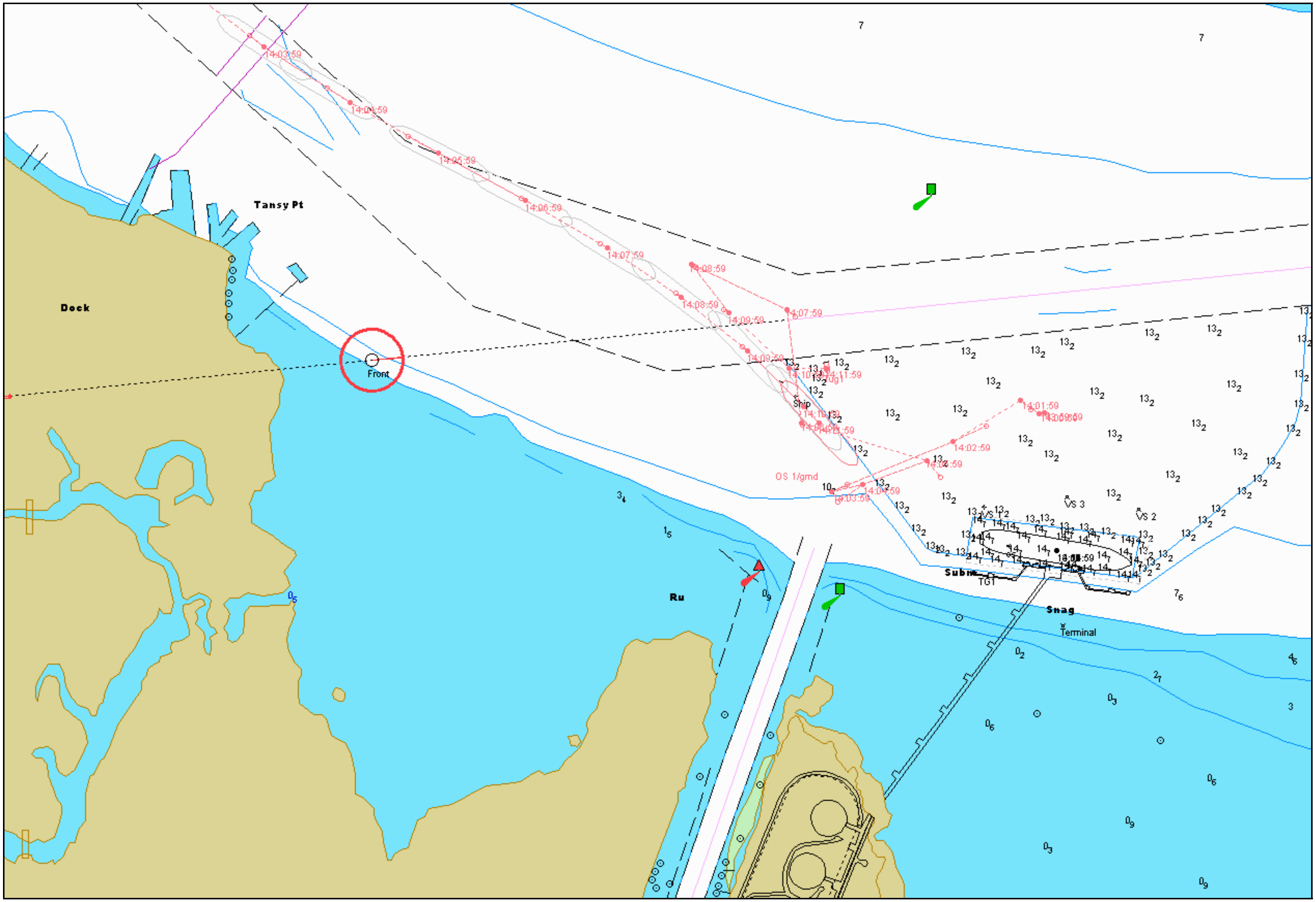


Simulation 38

Objective	Establish operational parameters for other vessel casualty scenarios.
Description	Inbound Ship type: Bulk Carrier, 104,510 Tons displacement Start Position: 0.5 mile from Tansy Point Start course and speed: 132T X 7.9 knots Current: Base Flood Tide: Lower Low Water Wind: SW 25 knots Waves: 1ft Tug forces used: 2 X 75T BP Standing by in basin
Significant Events	14:00 Started off at half ahead. 14:06 Hard starboard rudder failure. Tug assistance requested. 14:07 Stopped engine. 14:10 Tug on port quarter pushing easy. 14:11 Full astern. Ship's speed 5.6 knots. 14:12 Ship ran aground.
Conclusions	Could not control ship in time. Ship ran aground in the shallows while entering the LNG Terminal turning basin.

Continued on next page

Simulation 38 Continued

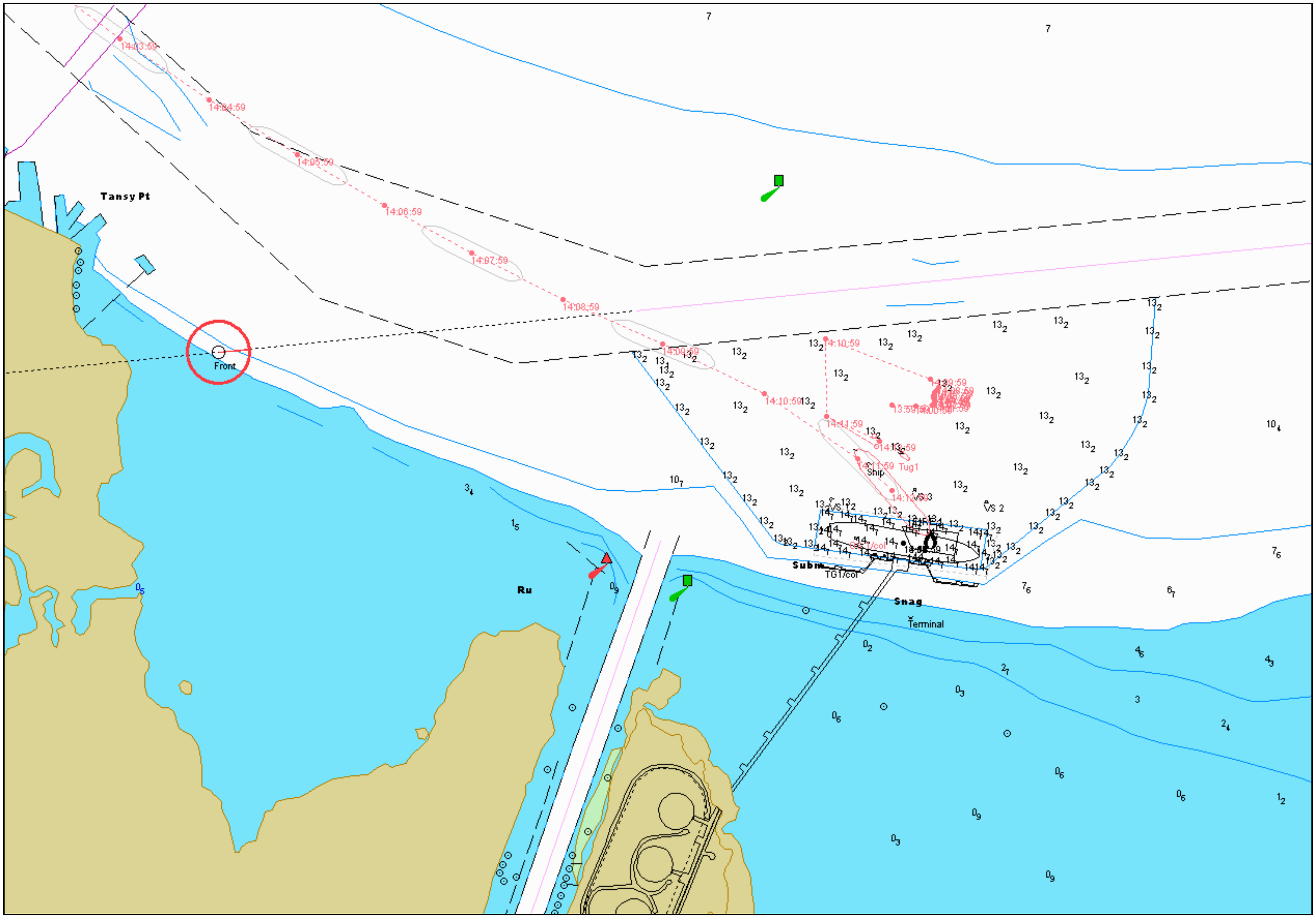


Simulation 3

Objective	Establish operational parameters for other vessel casualty scenarios.
Description	Inbound Ship type: Bulk Carrier, 104,510 Tons displacement Start Position: 0.5 mile from Tansy Point Start course and speed: 132T X 7.9 knots Current: Base Flood Tide: Lower Low Water Wind: SW 25 knots Waves: 1ft Tug forces used: 2 X 75T BP Standing by in basin
Significant Events	14:00 Started off at half ahead. 14:08 Hard port rudder and full ahead to negotiate Tansy Point Turn. 14:10 Hard starboard rudder and propulsion failure. Requested tug assistance. 14:11 Let go port anchor, 2 shots. Ship's speed 8.4 knots. 14:12 Let go starboard anchor, 1 shot. Tug on starboard quarter pushing full. 14:13 Collision with LNG Carrier.
Conclusions	Tugs unable to control bulk carrier before it strikes LNG ship docked at the terminal.

Continued on next page

Simulation 3 Continued

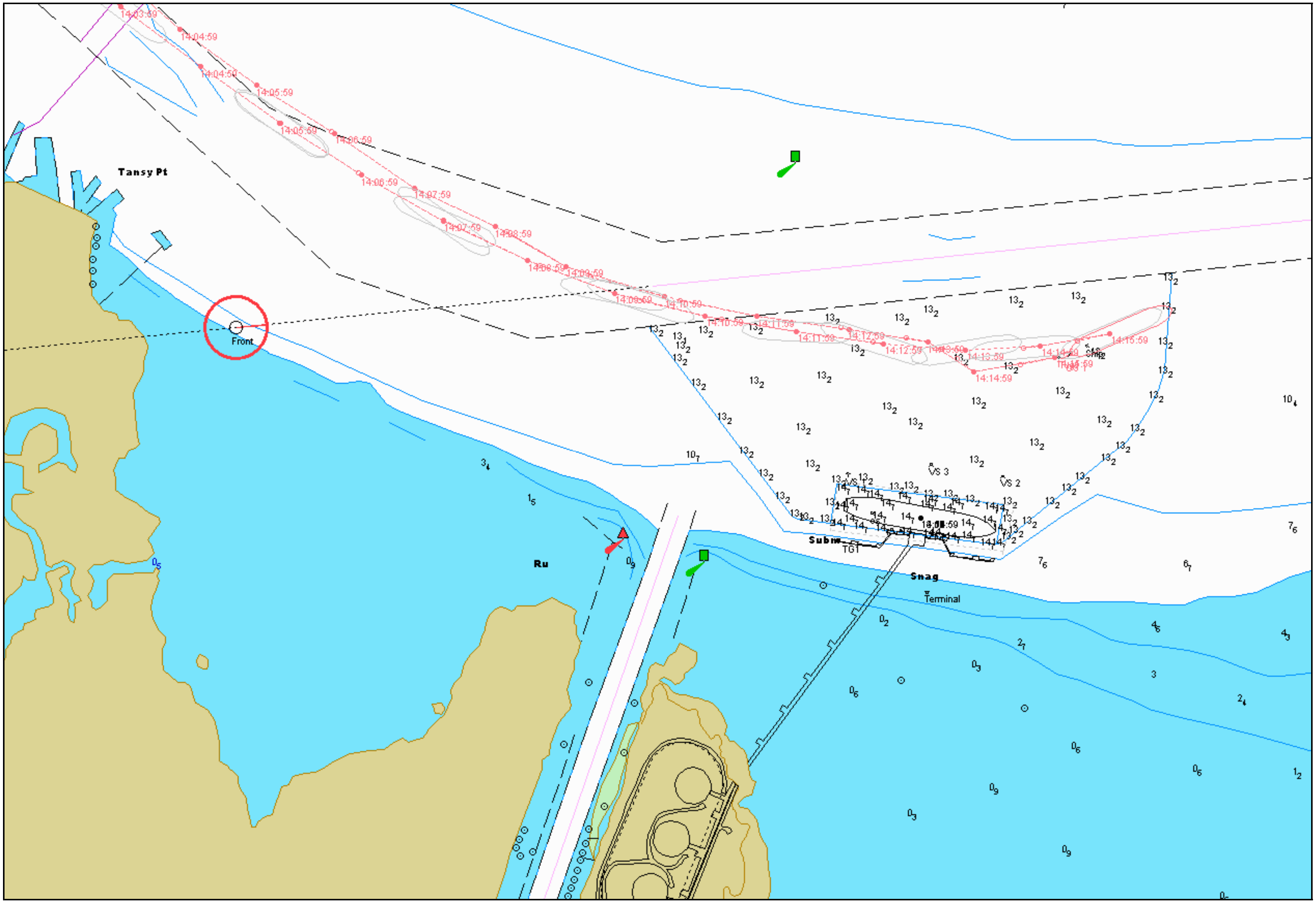


Simulation 4

Objective	Establish operational parameters for other vessel casualty scenarios.
Description	Inbound Ship type: Bulk Carrier, 104,510 Tons displacement Start Position: 0.5 mile from Tansy Point Start course and speed: 132T X 7.9 knots Current: Base Flood Tide: Lower Low Water Wind: SW 25 knots Waves: 1ft Tug forces used: 1 X 75T BP Standing by on starboard quarter, 1 X 75T BP standing by in basin
Significant Events	14:00 Started off at half ahead. 14:08 Hard port rudder and full ahead to negotiate Tansy Point Turn. 14:11 Hard starboard rudder and propulsion failure. Requested tug assistance. 14:12 Tug on port quarter pushing easy to maintain port rate of turn. Ship's speed 6.3 knots. 14:14 Tug on port quarter stopped. Second tug on starboard quarter pushing easy to full to counter port rate of turn.
Conclusions	Tug was able to apply forces quickly when failure occurred and controlled vessel.

Continued on next page

Simulation 4 Continued



Final Report

Mooring and Berthing Analyses, Oregon LNG Terminal

Prepared for

LNG Development Company, LLC
(d/b/a Oregon LNG)

January 2008

Prepared by

CH2MHILL

Contents

Tables

Figures

SECTION 1.0

Introduction

This report presents mooring and berthing analyses for the Oregon Liquefied Natural Gas (LNG) Terminal that will be located at Warrenton, Oregon, near the mouth of the Columbia River. The mooring and berthing analyses are provided in Sections 2.0 and 3.0, respectively.

SECTION 2.0

Mooring Analysis

The mooring system design process requires evaluation of the forces that a ship's mooring lines and pier fenders and bollards must resist. Sources of load on a ship at a pier-side mooring can be static, quasi-static, and dynamic:

- Static loads can be represented as a constant force such as a steady wind or current force.
- Quasi-static loads are understood to be dynamic but can be reliably represented by an equivalent static load, such as the use of a 30-second-duration wind speed to represent an unsteady or time-varying wind field.
- Dynamic loads include time-varying or unsteady winds, such as gusts or wind shifts where changes in speed or direction, currents, waves, and passing ship forces can occur. As waves are not anticipated to be significant at the location of the Oregon LNG Terminal, this analysis focuses on the mooring forces associated with steady wind and current and tidal changes at the Terminal site.

OPTIMOOR, a computer program from Tension Technology International, was used to evaluate static moored-ship behavior in three degrees of freedom, the horizontal plane directions of surge, sway, and yaw, relative to an initial equilibrium position:

- Vessel surge motion occurs in the longitudinal direction, fore and aft.
- Vessel sway motion occurs in the transverse direction, toward or away from the berth.
- Vessel yaw motion is an angular rotation about the ship's vertical axis.

Inputs to the program include: non-linear mooring-line load-extension characteristics; linear fender force-deflection relationships; mooring arrangement and berth geometry; tide conditions; the magnitude and direction of the applied environmental forces; and moored vessel wind and current force and moment coefficients. Results obtained from the program include maximum static mooring-line tensions, total bollard forces, fender reactions, and vessel excursions.

2.1 Environmental Data

A. **Water Levels:** From 2001 National Oceanic and Atmospheric Administration (NOAA) Tides and Current information for Astoria, Youngs Bay, Oregon, Station 9439026 (approximately 3 miles from the Terminal site):

MHHW – Mean Higher High Water	8.80 feet
MHW – Mean High Water	8.10 feet
MSL – Mean Sea Level	4.68 feet
MLW – Mean Low Water	1.25 feet
MLLW – Mean Lower Low Water	0.00 foot
Berth Water Depth	50 feet MLLW

B. **Current Speeds and Direction:** Adequate current speed data are not available for the Terminal location. Chapter 10, Columbia River, Oregon and Washington, in *United States Coast Pilot 7, Pacific Coast: California, Oregon, Washington, Hawaii, and Pacific Islands*, 2007 Edition, published by NOAA, the U.S. Department of Commerce, and the National Ocean Service, indicates that currents vary from 1 to 3 knots in the vicinity of the Terminal. This has been confirmed by limited current data collected near the Terminal site. However, due to the limited nature of the measured data, a maximum current speed of 5 knots has been assumed. Current direction has been assumed to be within 10 degrees of the berthing line. It is anticipated that adequate current speed and direction data will be collected prior to final design of the Terminal to verify these assumptions.

Berth Orientation:	78 degrees West of North
Maximum Ebb Current:	5 knots within 10 degrees of berthing line
Maximum Flood Current:	5 knots within 10 degrees of berthing line

C. **Wind Speeds and Direction:** Analyzed in 10-knot increments from 10 to 70 knots. This range is intended to cover all expected wind speeds up to and including the 100-year return period event. Table 1 shows the expected wind speeds for various return periods.

TABLE 1
Wind Speed Return Period Data (30-Second Gust)

Return Period (Years)	Wind Speed (nots)
2	45.0
5	49.4
10	52.4
15	54.1
20	55.2
25	56.1
30	56.9
40	58.0
50	58.9
75	60.5
100	61.7

2.2 Mooring Analysis, 266,000 m^3 Vessel

A. **Vessel Particulars:** The maximum design vessel considered was a 266,000 m^3 LNG tanker. The vessel particulars were obtained from the following general arrangements of a 216,000 m^3 vessel with its overall length (LOA) scaled to match the expected LOA of a 266,000 m^3 vessel. Figure 1 is the general arrangements used to obtain the 266,000 m^3 vessel characteristics.

Mooring-line information was assumed based upon the data provided for the Q-Flex LNG vessel. The ship’s lines are assumed to be 5.34-inch circumference high modulus

polyethylene (HMPE) lines with a break strength of 302 Kips. Line pre-tensions were set at 33.1 kips. Mooring tails were assumed to be nylon with a length of 36 feet and a strength of 412 kips. The allowable mooring-line tension is 55% of the line-breaking strength, per Oil Companies International Marine Forum (OCIMF) guidelines.

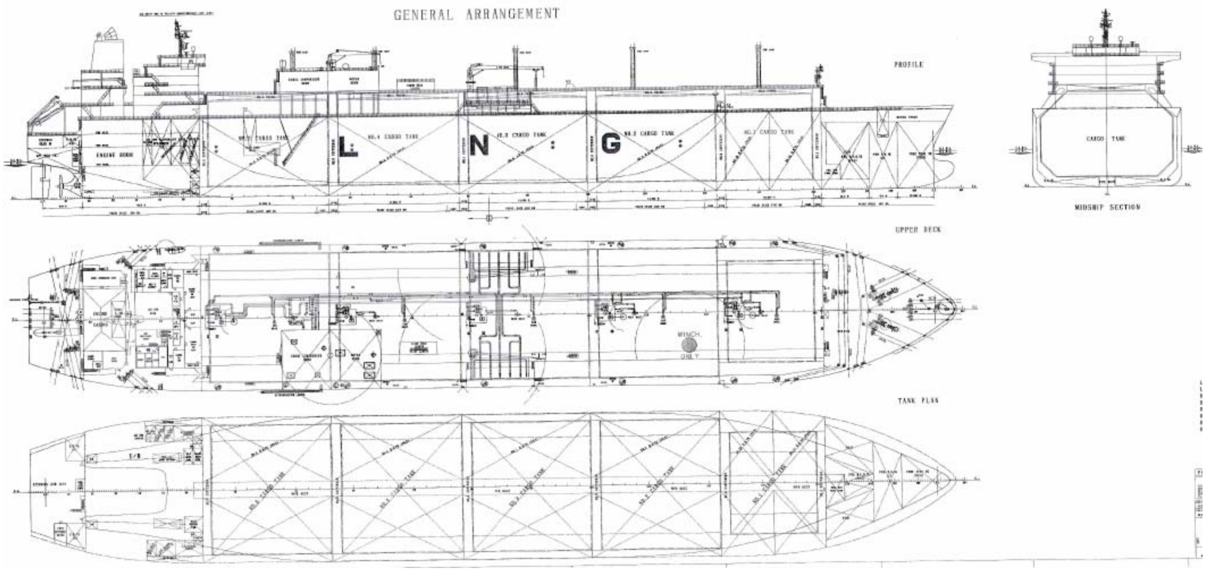


FIGURE 1
266,000 m³ Vessel Particulars

B. **Mooring Arrangement**: Figure 2 shows the berth arrangement for the facility with the 266,000 m³ vessel at the dock. This arrangement is designed to provide optimal performance over the entire range of wind and current speeds for the 266,000 m³ vessel. The arrangement uses 8 lines forward, 6 spring lines, and 8 lines aft. The symmetrical berth arrangement is designed such that the vessel can be berthed alongside either port or starboard.

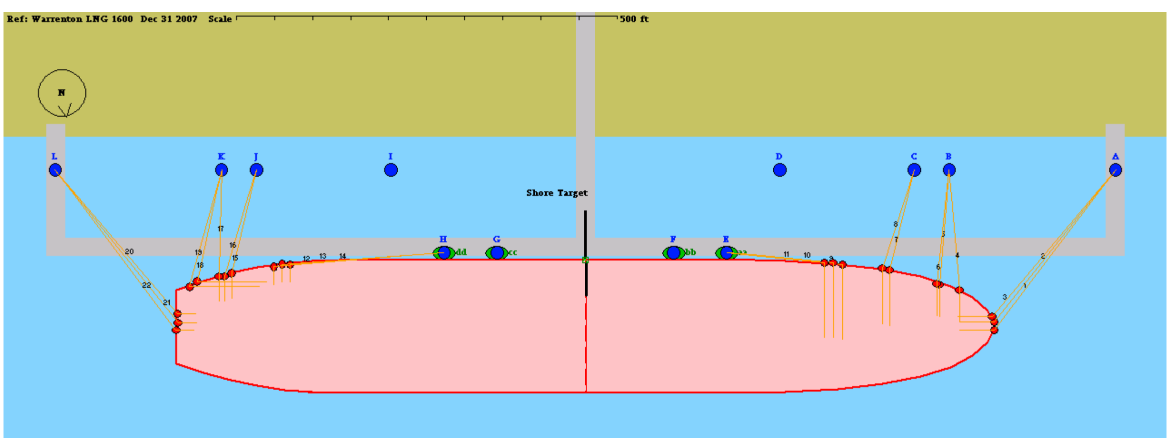


FIGURE 2
Berth Arrangement, 266,000 m³ Vessel

C. **Analysis Results:** The maximum mooring-line tensions for the range of wind speeds from 10 to 70 knots (all directions) and the range of current speeds from 0 to 5 knots (direction is within 10 degrees of berthing line) are shown in Figure 3. Line tensions for all the wind speeds shown in Table 1 are within the allowable range. All fender reactions are well within the rated fender capacity.

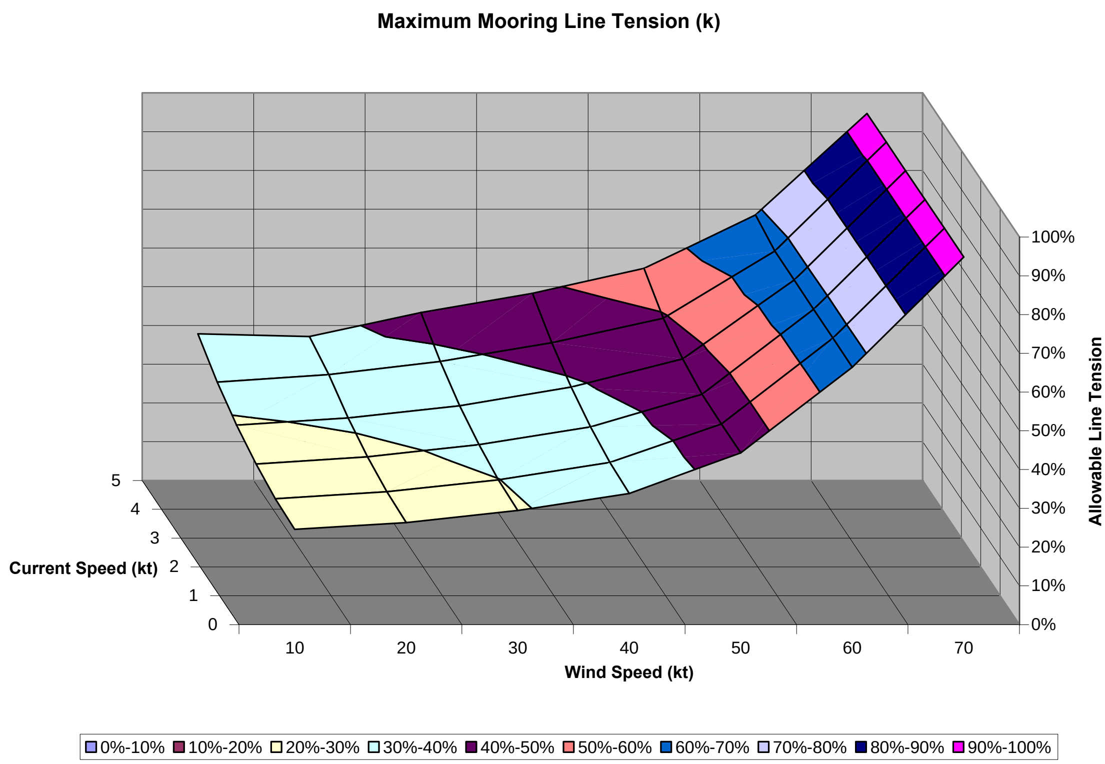


FIGURE 3
Maximum Mooring-Line Tensions, 266,000 m³ Vessel

2.3 Mooring Analysis, 70,000 m³ Vessel

A. **Vessel Particulars:** The minimum design vessel considered was a 70,000 m³ LNG spherical tanker. The representative ship chosen was the 74,000 m³ Gaz de France, which was built in 2004. The ship's basic parameters were obtained using Lloyd's Register. To approximate the line layout, windage areas, and other deck heights, the general arrangements for the TT Hoegh Gandria were used and scaled down to size as needed (see Figure 4). Mooring-line properties were assumed to be the same as for the 266,000 m³ vessel.

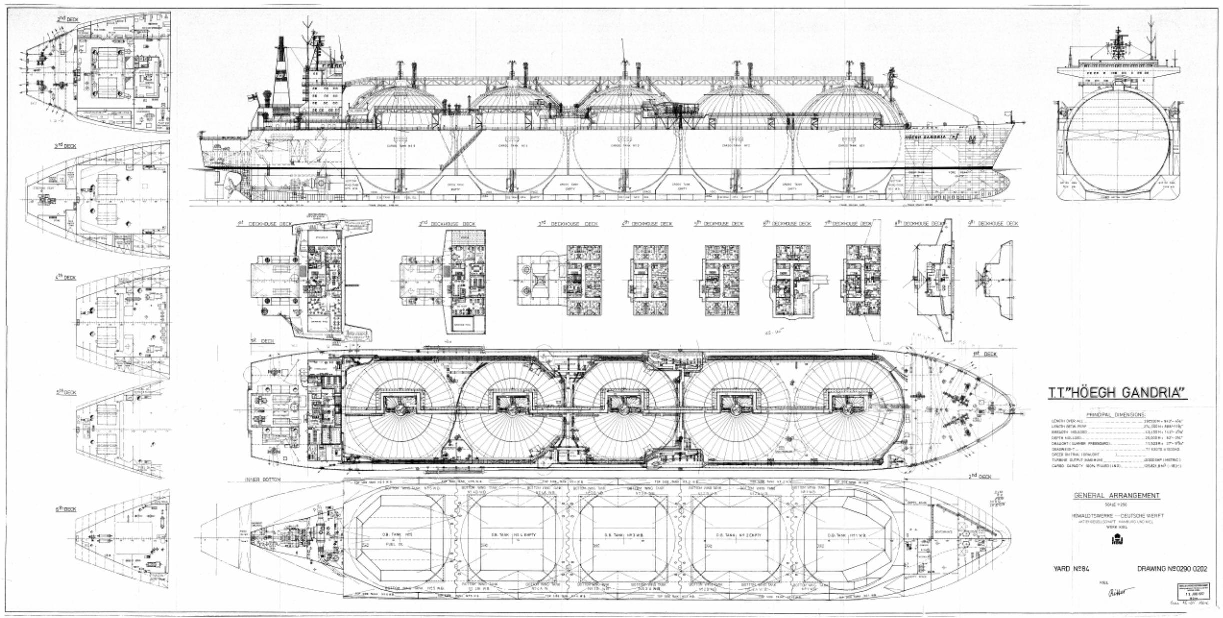


FIGURE 4
70,000 m³ Vessel Particulars

B. **Mooring Arrangement:** Figure 5 shows the mooring arrangement for the facility with the 70,000 m³ vessel at the dock. The vessel is located non-symmetrically on the berth due to the significant loading manifold offset from midships that is common on LNG vessels with spherical storage tanks. The arrangement uses 5 lines forward, 2 spring lines, and 5 lines aft. The symmetrical berth arrangement is designed such that the vessel can be berthed alongside either port or starboard.

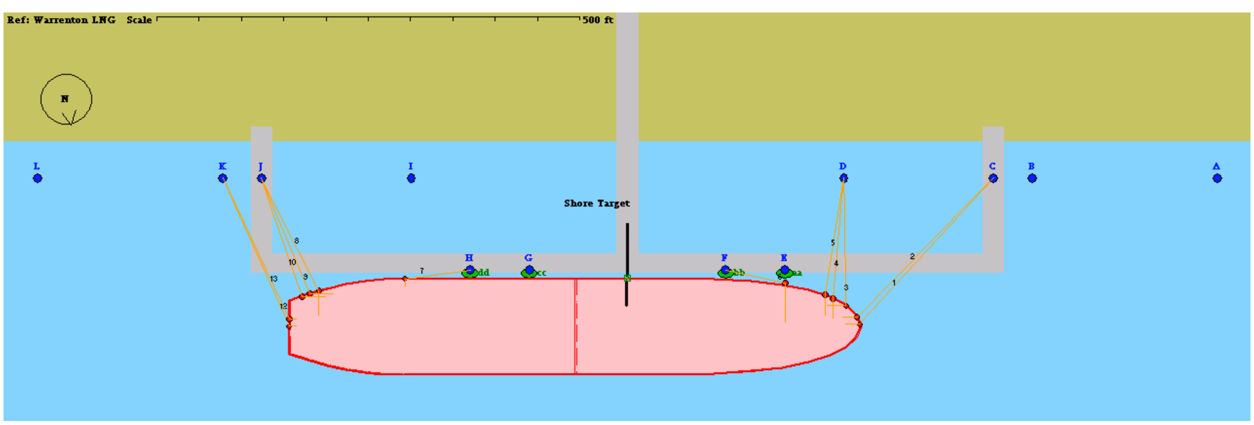


FIGURE 5
Berth Arrangement, 70,000 m³ Vessel

C. **Analysis Results:** The maximum mooring-line tensions for the range of wind speeds from 10 to 70 knots (all directions) and the range of current speeds from 0 to 5 knots (direction is within 10 degrees of berthing line) are shown in Figure 6. Line tensions for all the wind speeds up to and including the 100 year return period (See Table 1) are within the allowable range. All fender reactions are well within the rated fender capacity.

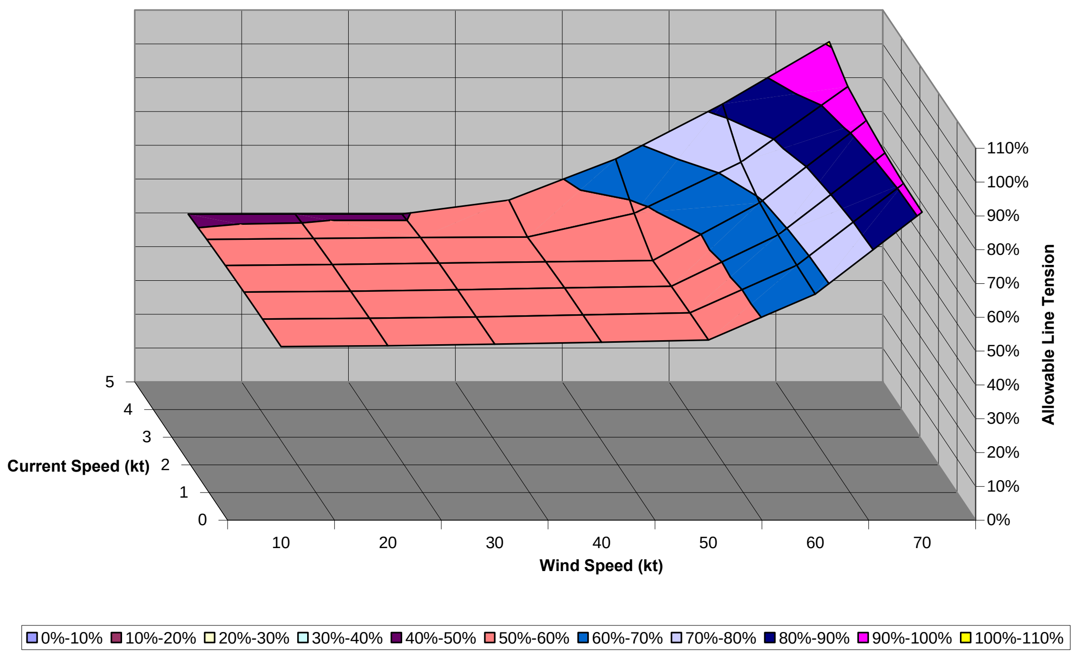


FIGURE 6
Maximum Mooring-Line Tensions, 70,000 m³ Vessel

It is important to note that because the berthing structures are arranged for optimal performance when berthing the 266,000 m³ vessel, the relative asymmetry of the 70,000 m³ vessel mooring arrangement produces higher line tensions, even for low wind and current speeds. This is considered acceptable because all line loads are within allowable stresses and it is expected that small vessels will call at the berth infrequently.

2.4 Passing Vessel Effects

It is well known that a vessel passing parallel to a moored vessel can impart significant hydrodynamic forces on the moored vessel, resulting in increased mooring-line loads. A review of existing data shows more than 50 "breakaway" failures in the U.S. from 1991 through 2001. In response to this phenomenon, the Naval Facilities Engineering Service Center has produced the computer program PASS-MOOR that estimates the forces imparted to a moored vessel by a passing vessel. This program was used to estimate passing vessel effects at the Oregon LNG Terminal.

A. **Analysis Parameters:** The following parameters were used for the passing vessel analysis:

Moored vessel:	266,000 m3 LNG vessel
Passing vessel:	266,000 m3 LNG vessel
Gap between vessels:	1,320 feet (passing vessel at edge of shipping channel)
Channel water depth:	43 feet
Berth water depth:	50 feet
Passing vessel speed:	12 knots

B. **Analysis Results:** Figure 7 shows the variations in maximum mooring-line tensions from passing vessels over time for the parameters listed above.

Due to the relatively large distance between the moored vessel and the passing vessel, as well as the adequate under-keel clearance at the berth, the passing vessel effects are small, at most increasing the maximum mooring-line tension by 9%. Combining the results of the maximum mooring line tensions (Figure 3) and the passing vessel analysis (Figure 7), it is apparent that for wind speeds of 60 knots or less, the combination of wind, current, and passing vessel will result in mooring-line tensions that are within allowable stress limits. Because it is reasonable to assume that vessels will not be transiting the shipping channel during periods where wind speed exceeds 60 knots, passing vessel effects should not result in overstress of the mooring lines.

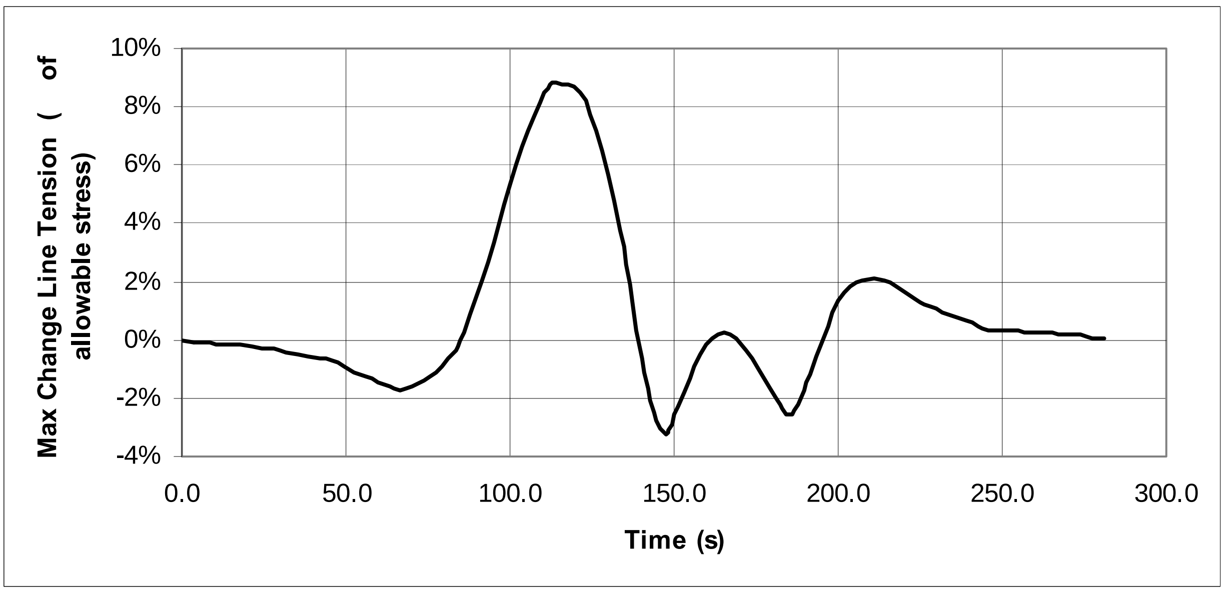


FIGURE 7
Variations Over Time in Maximum Mooring-Line Tensions from Passing Vessel

It is important to note that good line-tending practices at the berth are essential to avoid mooring line overstress damage or failure resulting from passing vessel effects. If lines are not tended adequately, resulting in slack lines, a so-called "snap" load could occur in the mooring lines. It is estimated in industry literature that mooring-line stresses could be magnified by a factor as high as 10 during a "snap" load event. The presence of automated line-tending equipment at the dock should preclude such an event.

SECTION 3.0

Berthing Analysis

The breasting dolphin pier fender system must withstand the maximum vessel berthing energy anticipated. Berthing energy is estimated based on vessel displacement, beam, draft, and an assumed approach velocity. Depending on the environmental conditions that occur when a vessel remains at berth, maximum reaction forces may actually occur during the time the ship is moored rather than at the time of berthing.

The kinetic energy method was used to compute vessel berthing energy that must be absorbed by a single fender. According to the Permanent International Association of Navigation Congresses, a 1/3–point berthing method is appropriate for breasting dolphins. The following berthing parameters were used in the analysis:

Berthing Method	1/3-point
Approach Angle	10°
Ce, Eccentricity Factor	0.799
Cm, Virtual Mass Factor	1.676
Cs, Softness Factor	1.0
Cc, Berth Configuration Factor	1.0
Approach Velocity	0.50 ft/sec
Cb, Berthing Coefficient	0.887
Abnormal Impact Factor	1.5

Based upon these parameters, the following results were calculated:

Vessel Berthing Energy (Normal Berthing)	2,074 ft-kips
Vessel Berthing Energy (Accidental Berthing) and Minimum Design Fender Energy Absorption	3,111.5 ft-kips
Vessel Berthing Energy (Corrected for Longitudinal Angular Compression)	3,523.8 ft-kips
Vessel Berthing Reaction Force	1,151.0 kips

Given the calculated energy and reaction force for the berthing of the vessel, it is recommended to use a Bridgestone SUC2500H (RE) with rated energy absorption at 52.5% deflection of 4,145.7 ft-kips and a reaction force of 1,151.0 kips.

COAST & HARBOR
ENGINEERING

Technical Memorandum

Tsunami Currents and Water Levels at LNG Ship Berth

1. Introduction

This Technical Memorandum is prepared upon request from CH2M HILL to document the analysis of October 18, 2007 provided to CH2M HILL concerning tsunami-generated currents and water level elevations at the LNG tanker ship berth. The analysis was based on output extracted from numerical tsunami modeling conducted for the proposed Liquid Natural Gas (LNG) facility located east of the Skipanon River at Warrenton, Oregon shown in Figure 1. The numerical modeling simulated propagation and transformation of the tsunami wave from the area of formation (subduction zone) toward the project site. The modeling results provided a time series of water surface elevations and current velocities during a 4,975 year combined earthquake and tide level event.

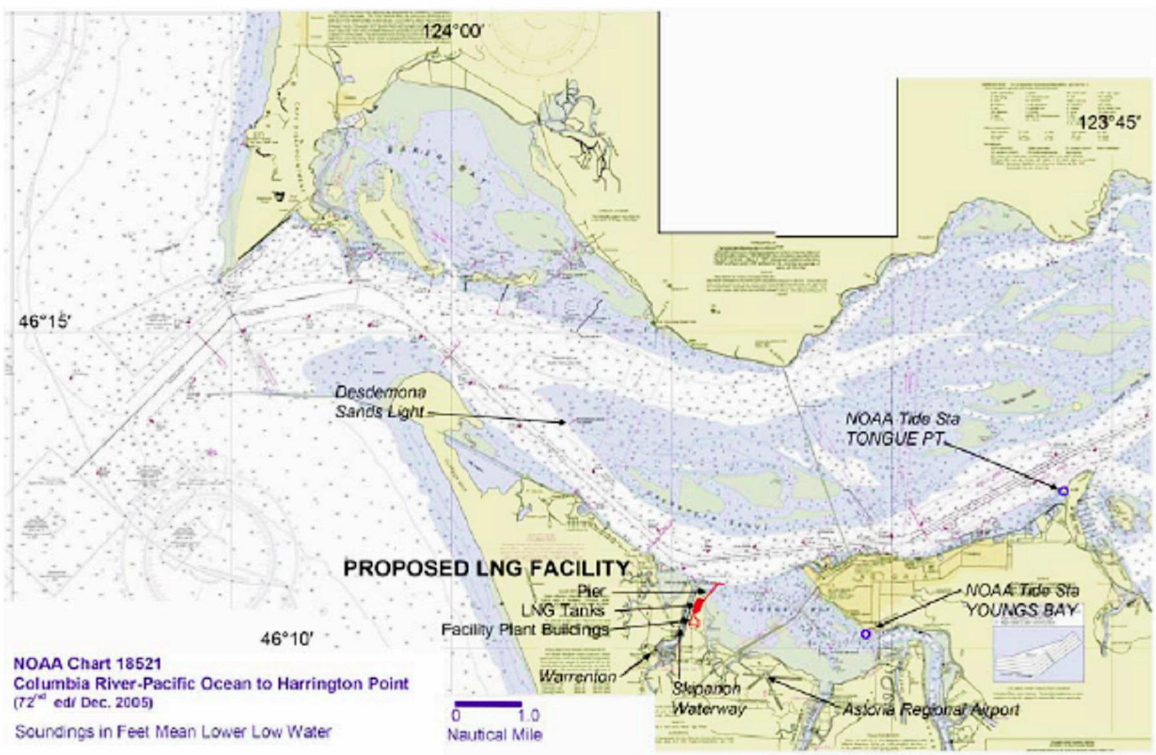


Figure 1. Proposed LNG Facility Location

2. Tsunami Modeling

Tsunami design event data were used in a 2-Dimensional tsunami wave transformation numerical model MORPHO, which is a depth-averaged flow simulation model capable of simulating water level fluctuations (waves), currents, sediment transport, bottom morphology changes (scour/deposition) and water quality. The tsunami design event was based on a magnitude 9.1 earthquake event with -4.3 ft land subsidence at the LNG facility. A tide level of 6.17 ft NAVD88 (North American Vertical Datum) was used in the modeling in which 0 ft NAVD88 = 0.17 ft MLLW (Mean Lower Low Water), as shown in Table 1. The reader is referred to two documents, CHE (2007a) and CHE (2007b), for a description of the numerical modeling and coastal hydraulics analysis.

Table 1. NOAA Tidal Datums for Youngs Bay

ASTORIA (YOUNGS BAY) TIDAL DATUMS[1]		
	Elevations	
Datum	**(ft-MLLW)**	**(ft-NAVD88)**
MEAN HIGHER HIGH WATER (MHHW)	8.80	8.63
MEAN HIGH WATER (MHW)	8.10	7.93
MEAN SEA MEAN LEVEL (MSL)	4.68	4.51
MEAN TIDE LEVEL (MTL)	4.67	4.50
MEAN LOW WATER (MLW)	1.25	1.08
NORTH AMERICAN VERTICAL DATUM-1988 (NAVD88)	0.17	0.0
MEAN LOWER LOW WATER (MLLW)	0.00	-0.17

Notes:
[1]Datums are from NOAA National Ocean Service ñPublished Bench Mark Sheet for 9439026 Astoria, Youngs Bayò, U.S. Department of Commerce. Publication date: July 15, 2004.
Length of Series: 1 month
Time Period: July 1981-July 1981
Tidal Epoch: 1983-2001
Control Tide Station: 9439040 Astoria, Tongue Point

3. Tsunami Generated Currents and Water Levels

A time series of current speeds and directions and water levels were extracted from output of numerical model MORPHO for ñExtraction Point 2ò shown in Figure 2. Extraction Point 2 is amidships of a moored LNG tanker at the terminal pier. Extraction Point 1 shown in Figure 2 was used to extract tsunami wave data used for hydraulic analysis of the shore-based structures of the proposed LNG facility.

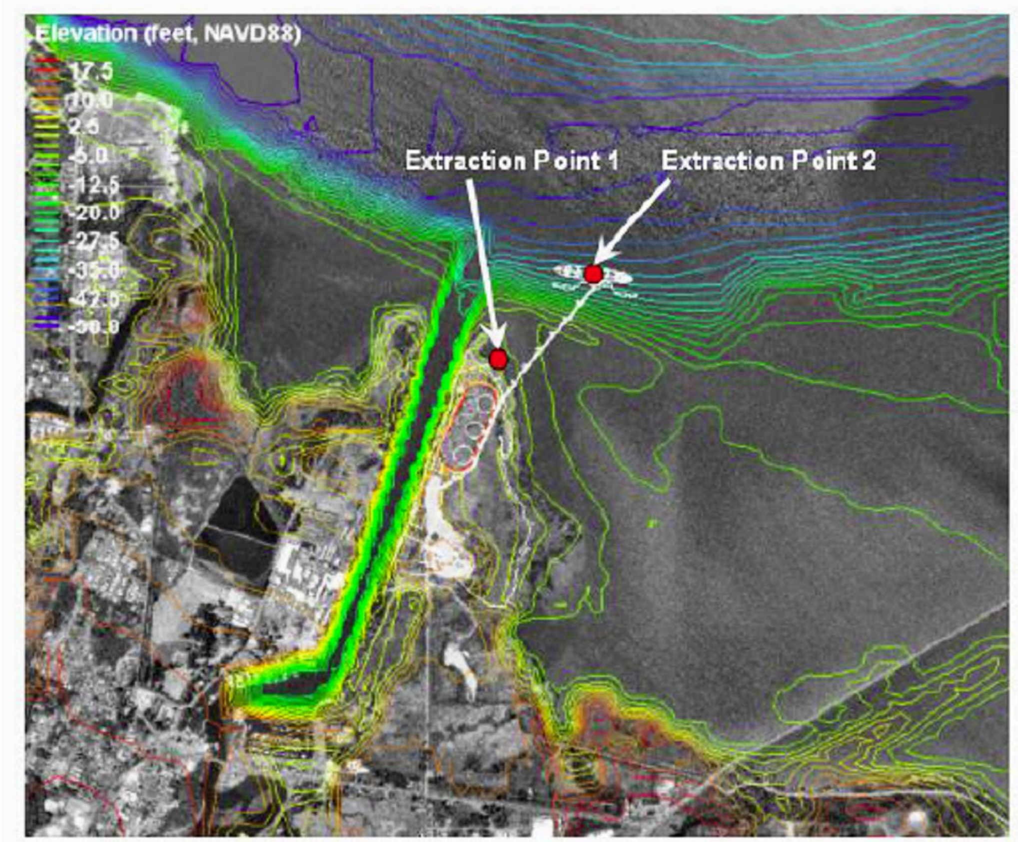


Figure 2. MORPHO Numerical Model Extraction Points and Bathymetry

Figure 3 shows output from the MORPHO numerical model for current flow at the time of maximum current speed at the moored tanker. Currents at the ship are shown to be flowing toward 126 degrees True (°T) at 7.2 ft/sec.

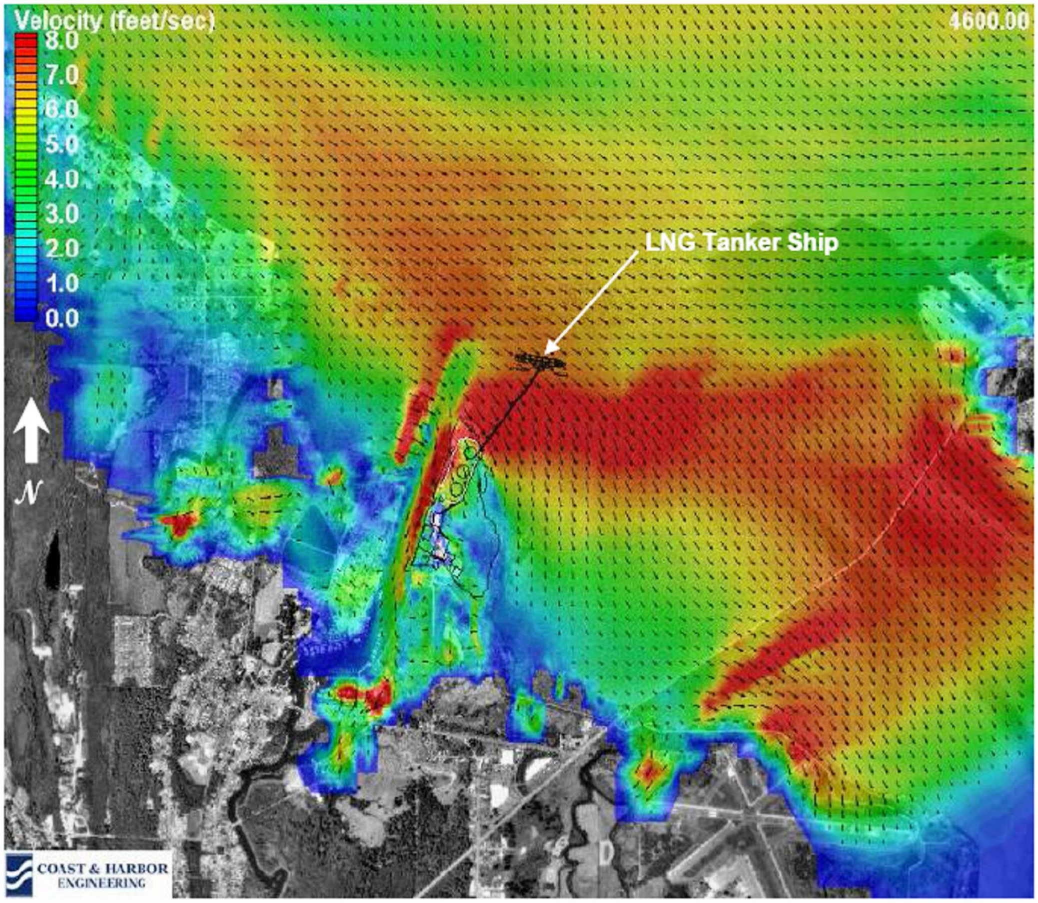


Figure 3. Maximum Tsunami Current During 1A-Asperity Earthquake Event with 4.3 ft Subsidence and Tide Elevation 6.17 ft NAVD88.

Figure 4 shows a plot of tsunami water level, current speed, and current direction for the moored location of the LNG tanker based on output extracted from numerical model MORPHO. Current direction is the direction toward which the water flows. For example, a current of 315°T would be for a current flowing toward the northwest. Assuming that the ship is moored exactly parallel to the berth, currents flowing approximately 100°T to 278°T would force the ship toward the pier, and currents approximately 098°T to 280°T would force the ship away from the pier.

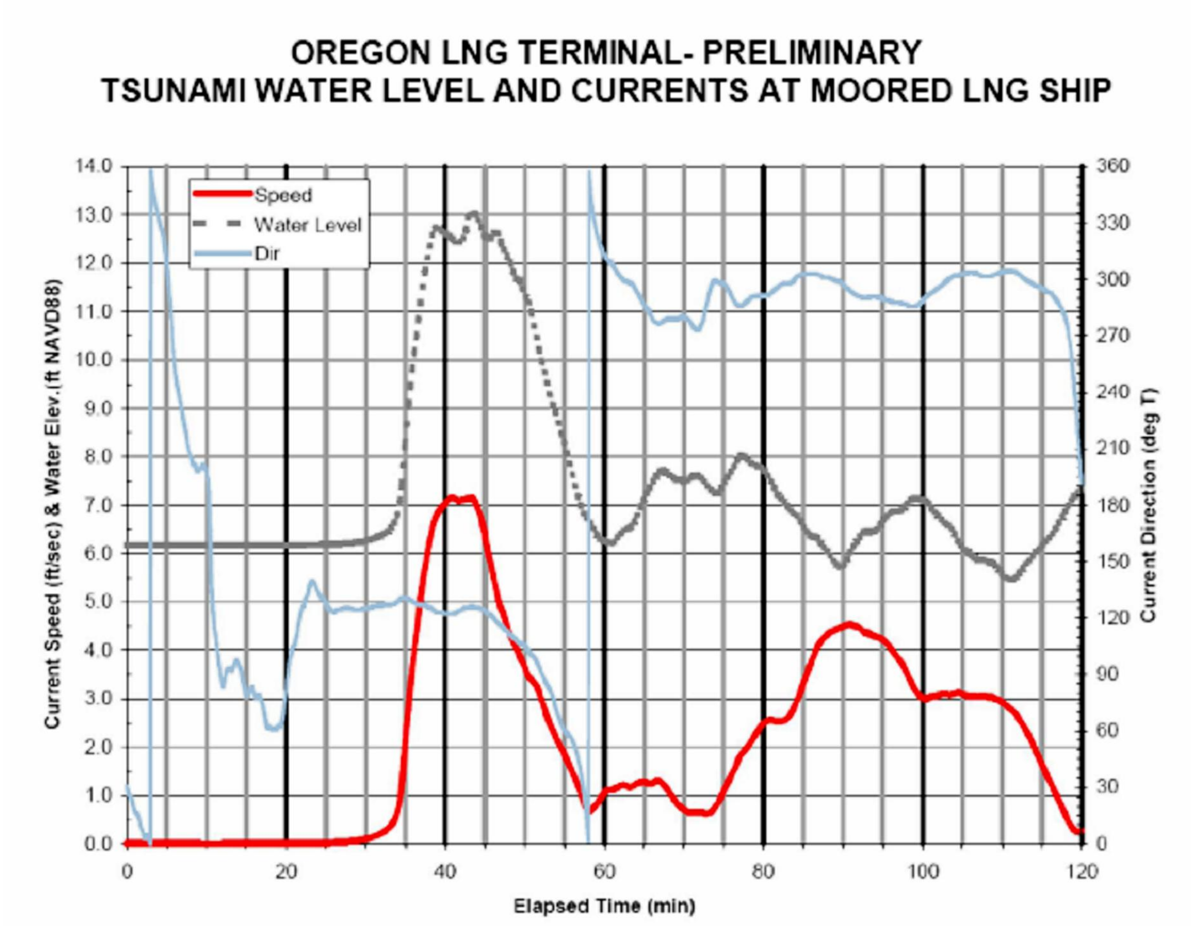


Figure 4. Tsunami Current Speeds and Directions and Water Levels at Moored LNG Tanker

With the initial tsunami wave arrival, the water level rapidly rises approximately 7 ft above tide level and then is followed by a rapid drop in water elevation with continued oscillations in water level. There are episodes of water level drawdown of up to -0.7 feet below tide level after about 90 minutes.

4. References

CHE. 2007a. ñTechnical Memorandum: Oregon LNG Tsunami Hydrodynamic Modelingò. Coast & Harbor Engineering. Edmonds, WA. October 2, 2007.

CHE. 2007b. *Technical Report: Oregon LNG Facility Coastal and Hydraulic Modeling Study.* Coast & Harbor Engineering. Edmonds, WA. December 5, 2007